ELECTRICAL REVIEW

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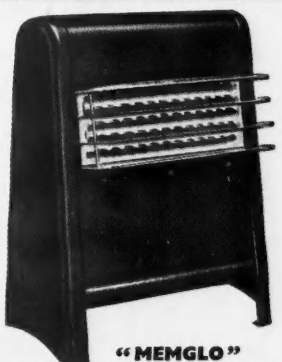

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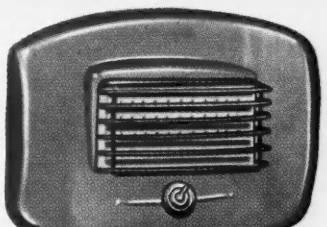

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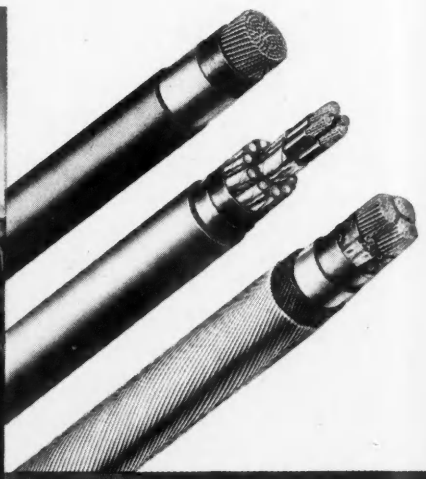

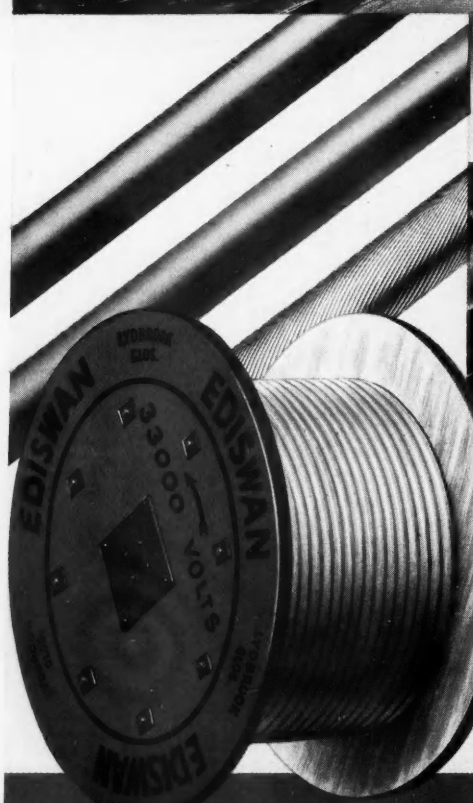

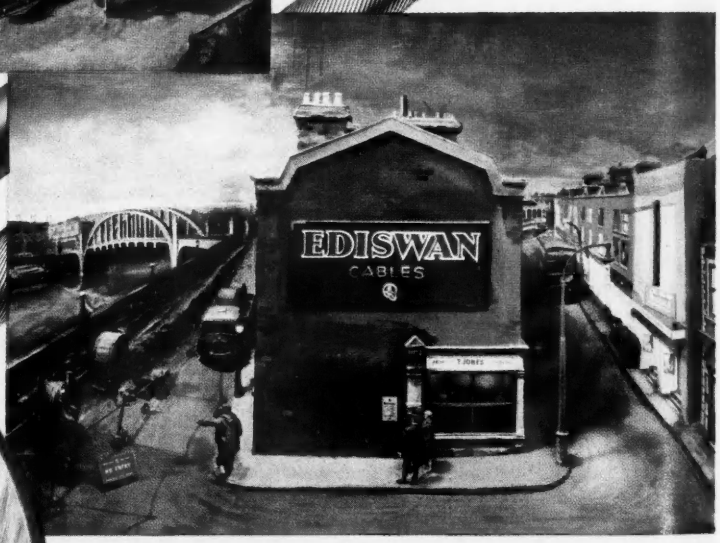

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5 AUGUST 1955

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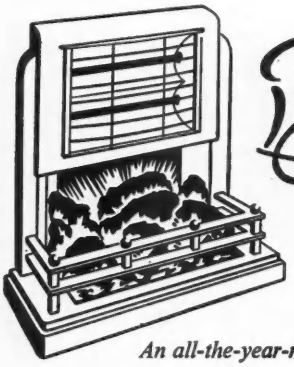

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ELECTRICAL REVIEW

5 August 1955 Vol. 157 No. 6 Established 1872

The "Credit Squeeze"

MR. BUTLER'S proposals for preventing further deterioration of external trade and currency conditions naturally touch the electrical industry at several points. How severely they will affect the industry is by no means certain for although in some ways the remedial measures will be applied indiscriminately (as in the case of the hire-purchase restrictions) the importance of electricity in the national economy should entitle the industry to special consideration.

We think the tightening of hire-purchase terms indiscriminate because it does not distinguish between " luxuries " and essentials; many of the electrical appliances upon which greater initial deposits are now to be demanded come within the latter class. It is of some comfort to see that the hire-purchase of cookers, water heaters and wash-boilers is not further handicapped.

The general direction, or request, to the banks to limit the granting of credit may do damage to an industry which is rapidly expanding. It is true that much of the extension work now being carried out is being financed from internal resources but there is a point beyond which many firms cannot go without bank loans or new capital and so far as the latter is concerned the Capital Issues Committee will doubtless scrutinize applications with an even more reluctant eye than usual.

Special mention was made by the Chancellor in the House of Commons debate to the Central Electricity Authority. He wisely said that the provision of generating plant could be held up only with danger to the regularity of the supply to industry. The C.E.A. was prepared, however, to " defer certain projects mainly in relation to distribution." Nowadays, of course, major distribution schemes are largely confined to new industrial areas, new towns or rural districts. All of them are of importance and the deferment of many of them would be detrimental to industry and agriculture. Mr. Butler also mentioned that the C.E.A., among other measures, was making provision, in raising charges, for financing part of its capital expenditure without borrowing. This, of course, is accepted industrial practice, but it is unfortunate that it coincides with the necessity to increase electricity prices because of much dearer coal.

It was not made clear in the debate to what extent building work was likely to be curtailed but it is evident that the Government intends that there shall be some reduction and the contracting section of the industry will be affected to some unknown extent.

Mr. Butler showed full appreciation of the urgent necessity of improving the railway service when he said very definitely that the railway modernization programme must go on. Any check on this programme would be bad for the future of the railways and for the morale of the railwaymen.

The success of the Chancellor's measures will depend entirely upon industry and the people of this country. It is his aim to divert more production to the export market at the expense of the home consumer. But with a will to give a full return for wages and salaries both export and home demands could easily be met without damage to our economy.

POWER STATION CONSTRUCTION

The main problem which arises when it is decided to build a generating station is the choice of a suitable site. The governing factors are availability of suitable land, good access for fuel supplies, adequate cooling water and reasonably close proximity to a heavy load centre. It is not often that a station is built on a site which does not meet all these points but in the case of Ince generating station near Chester, which is described in this issue, a certain amount of difficulty was experienced. The primary requirement in the case of this station was that it should be near one of the factories of the Atomic Energy Authority which required large amounts of electrical power. The site was finally chosen in spite of the fact that adequate cooling water supplies were not close at hand; in fact, cooling water is pumped from the River Dee which is some eight miles away from the station. This, however, does not appear to give rise to any undue operational difficulties. Another point about this station is that it is of semi-outdoor construction but this relates only to the boiler house and in fact at first glance the station appears to differ very little from a conventional plant. After visiting the station our impression is that there is ample scope for extending the experiment, at Ince or elsewhere, for as was made clear in Mr. F. H. S. Brown's I.E.E. paper, the question of power station thermal losses is a very formidable one.

CLEAN AIR

Many of the recommendations of the Beaver Committee on Air Pollution have been embodied in the Government's Clean Air Bill which is summarized in this issue. The main features are the prohibition, under severe penalties, of the emission of "dark smoke" and the compulsory use of grit arrestors for solid fuel furnaces. The Bill makes no reference to one point in the Beaver Report—the installation of gas-washing plant at power stations. Local authorities are empowered to establish "smoke control areas" and financial help is to be given to the householder who "incurs expenditure on adaptations in or in connection with the dwelling" to avoid contraventions of the Act. Although in many quarters this is held to apply only to solid fuel equipment there is no specific limitation and so the section may possibly cover electric fires and cookers. This is one of the points which may be cleared up when the Bill is considered by Parliament in the autumn. The Beaver Committee recommended the removal of purchase tax from electric and gas heaters. There is nothing in the Bill about this; actually it is an administrative matter which can be attended to at any time.

RAILWAY ELECTRIFICATION

A great deal of work has been done on railway electrification in this country and exports of British electric and diesel-electric traction equipment have been at a high level for many years. This might lead to the belief that we were in a powerful position in comparison with other countries when tendering for contracts abroad. We would be well advised, however, to keep an eye on development which has taken place in France since the war. That country now has what seems probably the most comprehensive system of railway electrification in the world and is conducting large-scale investigations and experiments in all aspects of the subject. With the completion of the 1,500 V d.c. main line electrification between Paris and Dijon in 1950 a new standard (62 m.p.h.) was set for European railway speeds over a 195-mile section. Much useful work has also been done in France on 50 c/s electrification and the measure of success can be judged by the developments and extensions to the system described in this issue.

RUGBY RADIO

When it was first built in 1926 the Post Office Radio Station at Rugby was the largest in the world. With the inauguration last week of its splendid new extension of twenty-eight transmitters, described in this issue, it appears once again to be unquestionably the largest of its kind. Two trends normal in any new engineering works are evident; the much greater consideration shown to the staff, with many provisions for their comfort and welfare; and the reduction in the operating personnel required by the extensive development of remote controls. Both trends reflect the increasing difficulty of obtaining suitable technical staff in the face of strong competition and also an appreciation of the boredom inherent in shift control work of this nature. In the new station one man will have perhaps twenty transmitters to control instead of the former one or two and this should undoubtedly keep him more active and alert. The continued improvement in efficiency which accompanies these latest developments, in conjunction with the reduction in operating costs brought about by a small staff, may help the Post Office to keep its international telephone charges to their present level or even to reduce them. In 1928 the cost of a transatlantic call was £3 a minute, in 1936 £1 8s and in 1946 £1, at which it remains. In modern economic conditions only continued technical advances can provide hope of a downward price movement. The Post Office, judging by its work at Rugby, has accomplished such advances.

BLANKETS AND PADS

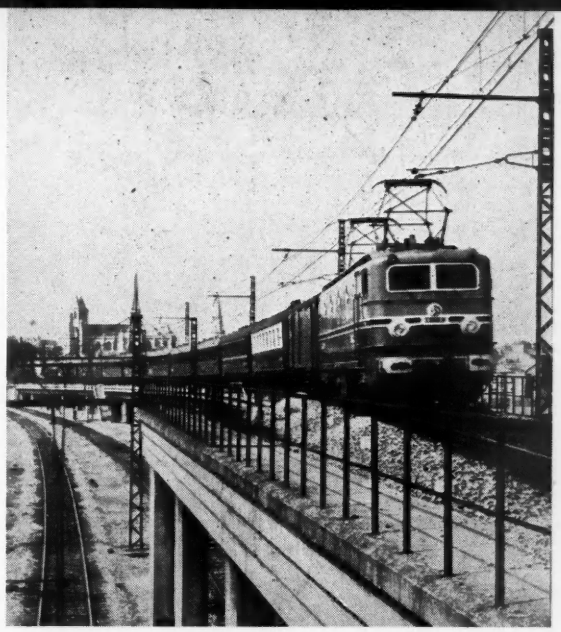
The next in our series of surveys of domestic electrical appliances will appear in our issue of 12th August, when we shall be dealing with electrically heated blankets and pads. Information, given in tabular form, will cover details of size, loading, method of control, colour, material, special features, price and purchase tax. As the demand for these surveys for reference purposes is heavy, orders for additional copies of the *Electrical Review* should be placed without delay. The following survey (2nd September) will deal with electric cookers.

French Railway Electrification

REVIEW OF CURRENT ELECTRIC LOCOMOTIVE PRACTICE

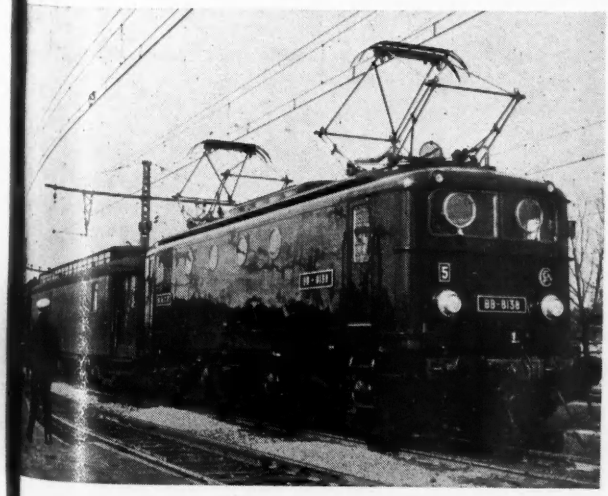
MAIN-LINE electrification in France has a history of over 40 years, but the international interest now commanded by French practice can be traced to events since the second world war. The conversion to electric working at 1,500 V d.c. of the Paris-Lyons main line was carried out in stages between 1949 and 1952. When completed as far as Dijon in 1950, the project set new standards in European railway speed by the introduction of a minimum average of 62 m.p.h. for all expresses to and from Paris over this section of 195·3 miles. After the opening to Lyons on 24th June, 1952, the "Mistral" express became the fastest train in the world over a comparable distance with a timing of 4 hr 15 min for the 317·5 miles between Paris and Lyons, with one intermediate stop. Later this was reduced to 4 hr 10 min, or an overall average of 76·3 m.p.h. The Paris-Dijon and Dijon-Lyons sections are each run at 77·1 m.p.h.

This daily high-speed running is at present subject to a general limit of 87 m.p.h. A higher maximum would permit still faster timings, and numerous trials have been carried out to test the stability of locomotives and rolling stock, and to measure the forces on the track, at the highest speeds now technically possible. It was in the course of these experiments that the French National Railways set up new world rail speed records on 21st February, 1954 (151 m.p.h.) and on 28th March last (205·6 m.p.h.), the latter speed being attained again on 29th March. The record runs this year (described in the *Electrical Review* of 9th April) were made on a section of the Bordeaux-Hendaye line where during 1954 a series of tests was made to establish the efficiency of current collection at very high speeds from a relatively light overhead system such as exists on the older electrified sections. It is evident, therefore, that the policy is to raise electric train speeds on main lines generally, although the Paris-Lyons line has been the proving ground for the types of locomotives developed for the purpose.



The train "Le Mistral" on the fly-over just outside Dijon station hauled by a "7100" class locomotive

Train 51 (Paris–Marseille) in Laroche station, hauled by one of the latest series 8101 Bo-Bo locomotives



At first two types of locomotives were built for the Paris-Lyons services, both of which were improved versions of designs with a long record of satisfactory service on other parts of the system. Technical progress made it possible, however, to increase the power outputs substantially, the larger type, for heavy, high-speed trains, being rated continuously at 4,400 h.p., or about 25 per cent more than its predecessors. The new mixed traffic locomotive marked an even more important step forward, its continuous rating of 2,500 h.p. comparing with 1,840 h.p. from previous designs of similar type. These increases in power combined with the higher axle loading permissible on the Paris-Lyons line enable considerably greater tonnages to be hauled.

Another important step was the use of compensated motors allowing an advanced degree of field-weakening while maintaining satisfactory commutation, and consequently wide range of economical running speeds. In the 4,400 h.p. locomotive the four traction motors can be connected in three groupings, in each of which seven weak-field steps are available, the minimum excitation being 29·4 per cent of that on full field. There is, therefore, a total of 24 economical running speeds. The smaller locomotive has 20 economical running speeds with only two groupings of the four motors, there being nine weak-field steps with a minimum of 24 per cent. These characteristics permit close control of speed in widely varying conditions of load and gradient so that both designs can deal efficiently with a considerable range of duties, and therefore have a high operating availability.

Rigid Wheelbase Locomotives

It was intended to build 95 locomotives of the 4,400 h.p. design, but the satisfactory development of new prototypes

has caused this number to be reduced to 35. The locomotive has a fixed four-axled driving wheelbase, with each axle driven independently by its own motor, and a two-axle guiding bogie at each end (2-Do-2 wheel arrangement). As the motors are carried in the main frame, a Büchli flexible transmission is incorporated in the gear drive to each axle to allow vertical and lateral movement of the axle relative to the frame.

The principal characteristics of the 2-Do-2 locomotives are as follows:—

Total weight in running order	144 tons
Driving wheel diameter...	5ft 9in
Bogie wheel diameter	3ft 3½in
Adhesive weight (minimum)	82 tons
,, ,, (maximum)	92 tons (with ballast)
Continuous rating (at 1,350 V)...	4,400 h.p.

Without exceeding the continuously rated performance the locomotive will haul 900 tons on the level at 87 m.p.h., 850 tons up a gradient of 1 in 125 at 53·4 m.p.h. and 1,000 tons up a gradient of 1 in 200 at 61 m.p.h.

The traction motors are wound for 1,500 V and are six-pole machines with interpoles and a compensating winding. Short-circuiting of the starting resistances, the transitions between the three motor groupings and field-shunting are effected by camshafts driven by electro-pneumatic servo motors. The low-voltage control circuits have been simplified by adopting a mechanical method for switching off the main servo motor when it has rotated the camshaft to the position selected by the driver on his controller.

In normal conditions the driver notches up to full parallel through 15 steps in each grouping of the motors, each step representing an increase in tractive effort of between 3 and 4 tons. For starting very heavy trains on slippery rails, however, he can use a fine control which sub-divides the main steps and reduces the increments of tractive effort to a little over half a ton. A separate electrically-driven camshaft and control handle are provided for connecting additional resistances in parallel with each main section in twin.

Auxiliary machines include four blowers for traction motor ventilation and two blowers for cooling the resistances while starting, the latter operating automatically on the resistance notches of the controller. The electrical equipment was built by the Compagnie Electro-Mecanique, and the mechanical parts by the Compagnie de Fives-Lille.

The 136 mixed traffic locomotives for the Paris-Lyons line are of the motor bogie type, all axles being motored so that the whole weight of the locomotive is used for adhesion (Bo-Bo wheel arrangement). Each two-axle bogie accommodates two axle-hung traction motors with single-reduction resilient gears. Leading characteristics are as follows:—

Total weight without ballast	80 tons
Total weight with ballast	92 tons
Wheel diameter	4ft 7in
Continuous rating (at 1,350 V)...	2,500 h.p.
Maximum service speed...	65 m.p.h.

Without exceeding the continuous rating the locomotives are capable of hauling a 680-ton passenger train up a gradient averaging 1 in 500 at 62 m.p.h. and hauling a 1,050-ton freight train up a gradient of 1 in 125 at 35 m.p.h.

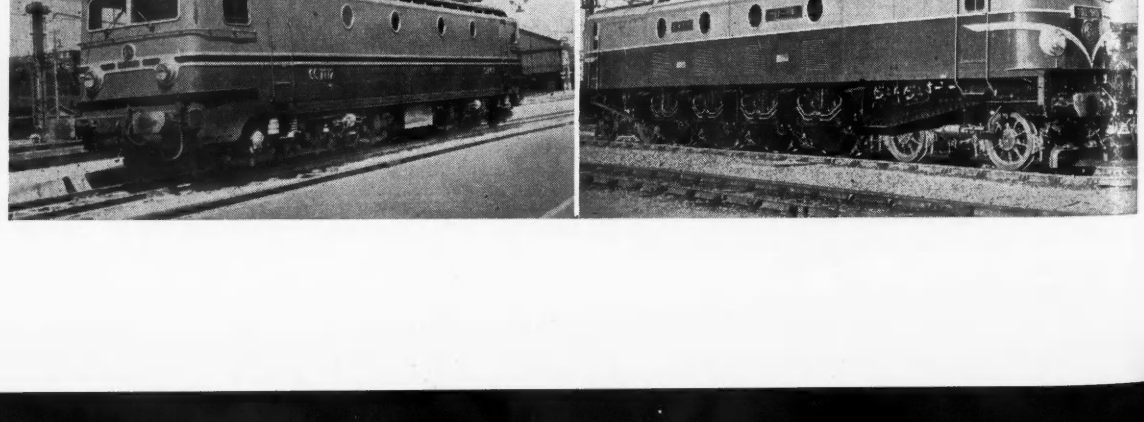
The six-pole compensated traction motors operate at half-line voltage, being connected all in series or in series-parallel, and in minimum field are running at 24 per cent of full excitation. Control of the resistance notching and field-weakening is by means of individual electro-pneumatic contactors, but the transition contactors are operated by a cam group. Bridge transition has been adopted in order to maintain the tractive effort at this stage of acceleration. Although there are 40 full-field steps, only 18 resistance contactors are used, the progressive reduction of resistance being assisted by series, series-parallel and parallel connection of the elements. Blowers suspended from the roof provide for traction motor ventilation and for maintaining an air pressure inside the body to prevent the ingress of dust and moisture.

Construction of these locomotives has been shared between the Société Alsthom, Le Materiel de Traction Electrique, Oerlikon, and the Compagnie Générale de Constructions de Locomotives.

Six-Axle High-Speed Locomotives

While the 2-Do-2 express locomotives described earlier were under construction, the French National Railways were studying the design of an express locomotive with all its axles motored. By eliminating non-motored guiding axles, the whole locomotive weight becomes available for adhesion, and so for a lower total weight and individual axle loading the adhesive weight may be greater than in a 2-Do-2 design. The wheel arrangement chosen comprised two three-axle motor bogies (Co-Co) and two prototypes appeared in 1949. Their success led to the decision to build no more of the 2-Do-2 type, and 58 of the Co-Co design were ordered from the Société Alsthom for service

Left: One of the "7100" class of Co-Co locomotives. Right: One of the 2-Do-2 "9100" class of locomotives



both on the Paris-Lyons line and on the South-Western Region of the railways. These locomotives form the "7100" class, which is now the most numerous post-war express type and was responsible for the world rail speed records of 1954 and the present year.

The use of heavy motor bogies for guiding a locomotive at very high speeds may be detrimental to the track and to the wheel flanges unless the pivoting and suspension system is carefully studied. In the "7100" class the connection between the locomotive body and each bogie takes the form of two normally vertical links which can swing in opposite directions to allow a turning movement of the bogie, or both in the same direction for relative lateral displacement of bogie and body, being restored to the vertical in both cases by sprung transverse stays. The restoring force is proportional to the amount of displacement, and may be different at the front and rear axles, so that the system adapts itself readily to all the complex movements the bogie may make on the track.

The Co-Co locomotives have the following principal characteristics:—

Total weight in running order	106 tons
Adhesive weight	106 tons
Wheel diameter	4ft 1in
Continuous rating at 1,500 V	4,400 h.p.
Weight per axle	17·6 tons*

*In the 2-Do-2 type the driving axle load is 20 tons, and the adhesive weight 80 tons for a total locomotive weight of 144 tons.

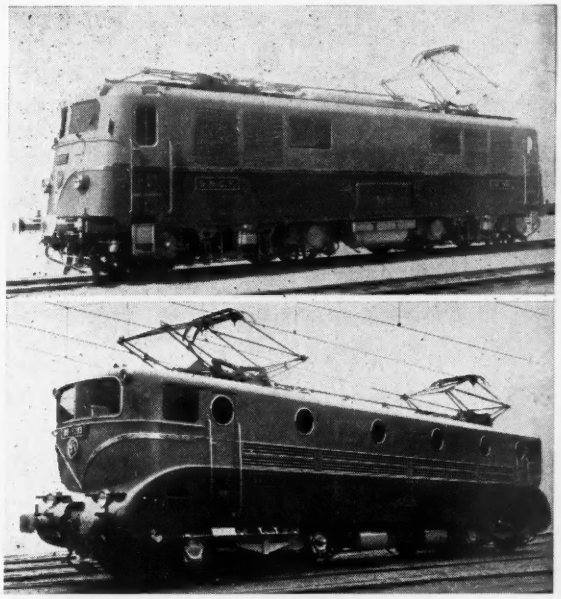
Without exceeding the continuous rating, the locomotives will haul the following loads in the conditions specified:—An 850-ton passenger train on level track at 84 m.p.h., or up a gradient of 1 in 125 at 56 m.p.h.; and a 1,300-ton goods train up a gradient of 1 in 200 at 34 m.p.h. The tractive effort/speed curves for these locomotives show a balancing speed of 99·4 m.p.h. when running on the level in minimum field with a 700-ton train.

The traction motors are wholly supported from the bogie frames, and the transmission therefore embodies a flexible coupling to the driving wheels so that they can move with the springing without varying the distance between centres of the motor pinions and gearwheels. In the first 43 locomotives the six-pole traction motors are compensated and will operate with a minimum field of 27 per cent. The remaining locomotives have uncompensated motors because with the three groupings available in a six-motor scheme, a sufficient number of economic running speeds for most purposes can be provided without resorting to extended field shunting.

Control of the resistances is effected by electro-pneumatic contactors, but electro-pneumatic cam groups are used for field shunting and reversing. Two motor-blower units suspended from the roof furnish air for traction motor ventilation and for maintaining a pressure inside the body.

High-Speed Bo-Bo Locomotives

The success of lightweight high-speed four-axle locomotives in Switzerland since the second world war led to the decision to experiment in France with similar designs, and four prototypes were ordered. Weighing only 80 tons, they are of similar power and performance characteristics to the 106-ton "7100" class. Locomotives Nos. 9001 and 9002 are of Swiss design and built by Brown Boveri and the Swiss Locomotive & Machine Works. Nos. 9003 and 9004 were developed by French firms in conjunction with the railways, the mechanical parts being built by the Forges et Ateliers du Creusot, and the control equipment by the Société Jeumont. Oerlikon motors are fitted to 9003 while those in 9004 are by Schneider Westinghouse. The latter are uncompensated, and will operate with a minimum field of 40 per cent,



Top: High-speed Bo-Bo locomotive No. 9001, of Swiss design and construction. Bottom: French-built high-speed Bo-Bo prototype No. 9003

whereas the compensated Oerlikon motors go down to 30 per cent excitation. Leading characteristics of the Swiss-built and French-built locomotives are as follows:—

	9001/2	9003/4
Total weight	80 tons	80 tons
Continuous rating (at 1,500 V)	4,170 h.p.	4,320 h.p.
Speed on level with 900-ton train	87 m.p.h.	87 m.p.h.
Wheel diameter	4ft 3in	4ft 1in

The Swiss locomotives use the S.L.M. bogie and suspension system which has proved itself over a number of years in high-speed locomotives of the Swiss Federal Railways having the same wheel arrangement. Transmission from the bogie-mounted motors is by means of the Brown Boveri flexible disc drive. A similar electrically-operated camshaft control system is fitted both in the Swiss and the French locomotives and provides series-parallel and parallel connection of the four 1,500 V motors. With eight weak-field steps in each grouping (minimum 24 per cent), the Swiss-built locomotives have 18 economical running speeds, as compared with 12 in the French design, but the numbers of resistance notches are respectively 28 and 40. Forced ventilation of the resistances and the ability to run without limitation of time on any resistance notch are common to both designs.

In evolving their design, the French engineers have adopted a bogie pivoting system using lateral and longitudinal linkages with Silentbloc mountings, and the tractive forces are transmitted from the bogies to the body by means of coupling bars attached to the bogie structure approximately in the plane of the axles. By this arrangement the tendency for the bogies to tilt when starting heavy trains, causing slipping of the leading axles, is reduced. A similar effect is produced in the Swiss S.L.M. bogie by inverting the normal pivoting arrangement. These measures are of particular importance in light four-axle locomotives developing over 4,000 h.p. It was one of the French prototypes, No. 9004, which took part in the high-speed trials last March and attained 205·6 m.p.h.

The traction motors of these locomotives are fully spring-borne in the bogie frames. The flexible trans-

mission system takes the form of a short cardan shaft enclosing the driving axle and universally-jointed at one end to the final gearwheel, and at the other end to the driving wheel.

While the work of electrifying the Paris-Lyons main line at 1,500 V d.c. was still in progress, the French National Railways were pursuing their experiments with single-phase traction at the industrial frequency of 50 c/s, and were operating a number of prototype locomotives and motor coaches on the line from Aix-les-Bains to Annecy and La Roche-sur-Foron in the Savoy. The experience gained led to the decision to use the 50 c/s system on the main line between Valenciennes and Thionville in North-Eastern France, and the first stage of this project between Valenciennes and Charleville (109 miles) was inaugurated on 5th August, 1954, the further 66 miles to Thionville being electrified on 29th June last.

Four types of locomotives are being built for this electrification. Two of them are six-axle (Co-Co) designs with rotary converting equipment, and the other two are four-axle (Bo-Bo) designs with single-phase series motors or d.c. motors fed through ignitron rectifiers. The characteristics of all these locomotives were described in detail in papers presented to the Institution of Electrical Engineers in London on 6th May, 1954, by MM. Garreau and Nouvion, of the French National Railways, and therefore only the fundamental differences between them are dealt with below.

The most numerous class, comprising 102 Co-Co locomotives, is being built by the Société Alsthom. Power from the overhead line is converted into d.c. in the locomotive by means of a motor-generator set driven by a single-phase synchronous motor. Speed is controlled by varying the excitation of the two d.c. generators, each of which is connected to the motors of one bogie. In addition to its normal series winding, each traction motor has a separately-excited winding which opposes the series field and becomes increasingly effective as the generator voltage is increased. The result is similar to field-shunting, and permits a reduction in size of the main generators for a given performance, while giving higher tractive efforts at the top end of the speed range.

In the second Co-Co class of locomotives, six squirrel-cage traction motors are supplied with three-phase current at variable frequency, the rotaries in the locomotive comprising a phase-convertor and a frequency-changer. A d.c. generator coupled to the phase-convertor supplies current to a motor driving the rotor of the frequency-changer. Adjustment of the generator excitation enables the rotor speed to be varied and provides stepless control of the three-phase output frequency. Twenty of these locomotives are being built by Oerlikon. The two Co-Co designs are used for hauling heavy freight trains, their loads sometimes reaching 1,800 tons, and have the following characteristics:—

	a.c./d.c.	Single-phase/three-phase
Weight	120 tons	120 tons
Horse-power (1-hr.)	2,490 h.p.	4,120 h.p.
Maximum speed ...	37 m.p.h.	37 m.p.h.
Tractive effort (1-hr.)	54,000 lb at 16 m.p.h.	61,000 lb at 25 m.p.h.
Wheel diameter ...	3ft 7½in	3ft 7½in

The rectifier and single-phase motor locomotives are for working the lighter and faster trains. Both have a similar arrangement of control on the high-tension side of the transformer. In the five rectifier locomotives the transformer output is applied to eight ignitrons which are connected in four pairs to provide full-wave rectification for each traction motor. The 15 locomotives with 50 c/s motors are provided with means for automatic variation according to speed of the value of interpole shunt, so that there is effective correction of the transformer effect over the whole working speed range. The electrical equipment of both Bo-Bo designs has been supplied by Matériel de Traction Electrique and the mechanical parts by the Société des Forges et Ateliers du Creusot. Their characteristics are as follows:—

	Rectifier type	a.c. motor type
Weight	84 tons	84 tons
Horse-power (1-hr.)	3,580 h.p.	2,720 h.p.
Tractive effort (1-hr.)	39,600 lb at 32 m.p.h.	28,500 lb at 33 m.p.h.
Wheel diameter ...	4ft 1¼in	4ft 1¼in

All these latest 50 c/s locomotives embody mechanical features similar to the d.c. designs of corresponding wheel arrangement—the Co-Co machines having the same bogie pivoting system as the Paris-Lyons "7100" class, but with axle-hung motors; while the Bo-Bo have a modified form of the bogies and suspension used in the high-speed d.c. locomotives 9003 and 9004. All four designs have a single central driving cab and in the Bo-Bo locomotives the tap-changer is adjacent to the control desk and is operated by direct mechanical drive from the driver's handwheel.

The development of new 1,500 V d.c. locomotives in France simultaneously with the work done on the 50 c/s system is explained by the administration's interest in the mechanical problems of the high-speed electric locomotive. Designs which have proved themselves on the d.c. main lines will be adapted to take a.c. equipment when the 50 c/s system is extended. The forthcoming electrifications to Basle and Strasbourg, on which express passenger trains will be worked by 50 c/s locomotives, will give the opportunity to demonstrate the fruits of this policy.

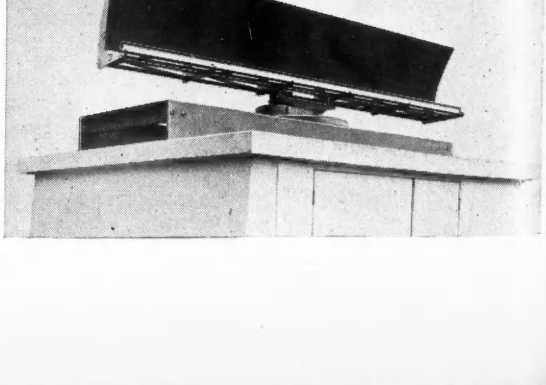
Storm Warning Radar Equipment

A NEW type of high-power storm detection radar has recently been put into production by Marconi's Wireless Telegraph Co., Ltd., and one of the first purchasers of the equipment is the Meteorological Department of the Federation of Rhodesia and Nyasaland. The equipment operates within the frequency-band 9,360-9,460 Mc/s, with a peak power output of approximately 50 kW. The design of the transmitter unit is based on that of the Marconi "Radiolocator IV" marine radar.

The scanner unit, driven by a 3 h.p. motor, is capable of continuous rotation at speeds of 5, 10, 15 and 20 r.p.m.; it is designed to maintain normal operation in wind speeds up to 80 m.p.h. By means of an actuator the aerial elevation may be power tilted in the vertical plane from −2 deg to +12 deg relative to the horizontal.

In the main display unit an off-centring mechanism allows the time-base origin to be displaced radially for a distance up to one radius of the cathode ray tube face in any desired direction. In this way a selected sector of the sweep may be expanded to cover the whole area of the tube. The power supply unit comprises a motor-alternator, and an auto-control panel which contains the starter and regulator.

Marconi storm warning radar scanner



The London Meeting of the I.E.C.

Work of the Technical Committees

FROM A SPECIAL CORRESPONDENT

AN account of some activities of the I.E.C. during its General Meeting in London during the period June 28th—July 9th has already appeared in these pages. A more detailed analysis of the proceedings of the technical committees and of the Council and Committee of Action is now given.

The Council meets every three years for the election of officers and of members of the Committee of Action, among other items, and on this occasion the chair was taken by Dr. H. S. Osborne (U.S.A.) up to the moment when he handed over the presidency to Dr. P. Dunsheath. Thailand was elected as a new member of the Commission, and it was reported that Turkey had applied for membership. New Zealand had indicated their interest, with the probability of the formation of a National Committee, and contacts had been established between the secretary of the I.E.C. and interested parties in Greece and Roumania.

The growth of the work of the I.E.C. is reflected in the figures presented by the treasurer for the expenditure by the Central Office in Geneva during the past few years. In 1948/49 the expenditure was 86,000 Swiss francs and this figure has steadily grown to 242,000 Sw.fr. in 1953/54. The income of the I.E.C. last year was 258,000 Sw.fr., made up of subscriptions from National Committees, 225,000 Sw.fr., sales of publications, 31,000 Sw.fr., subvention from UNESCO, 2,000 Sw.fr. The U.K. contribution amounts to 22,000 Sw.fr., this being paid by the British Standards Institution on behalf of the British National Committee.

Dr. Tornebohm (Sweden), president of the International Organization for Standardization (I.S.O.), was not able to accept the invitation to attend the Council meeting and Sir Roger Duncalfe, president-elect of I.S.O. deputized for him. The Council passed a resolution of appreciation and thanks to Dr. Schiesser (Switzerland) who for the past three years had been acting as deputy to the president, but was unable, through illness, to attend the present meeting.

Increased Interest in Standardization

Dr. Osborne, the retiring president, referred to the rapidly increasing interest in international standardization in the electrical and other fields. He thought it was important to study the question of the future work of the I.E.C. so as to concentrate activity on the more important items of new work. He suggested the appointment of a small planning committee for this purpose, and he stressed the desirability of keeping in close touch with the planning committee already set up by the I.S.O. This proposal was noted and referred to the Committee of Action for further consideration.

The Council then proceeded to the election of three members of the Committee of Action to fill the vacancies caused by the retirement of the members representing Czechoslovakia, the U.S.A. and the U.S.S.R. who had served their full term of nine years. Canada, France and Germany were elected, thus joining Belgium, India, Italy, Netherlands, Norway and the U.K. representatives whose terms of office have not yet expired.

Two meetings of the Committee of Action were held, one before and one after the Council meeting. The chair at the first was occupied by Dr. Osborne, the retiring president, and at the second by Dr. Dunsheath, the newly-elected president. Mr. L. Ruppert, the secretary of the I.E.C., presented a general report on the activities of the Commission during the past year. In this period the Central Office has issued about 500 documents relating to the work of the technical committees. Twelve new or revised specifications were published and a further seven were at present in the hands of the printer. Eleven specifications had been circulated (under the two months' procedure) for final approval, and 27 had been circulated (under the six months' rule) for provisional approval. This long list of documents approaching the publication stage was largely due to the intense activity at the meetings of 47 committees during the Golden Jubilee meeting in Philadelphia last September.

Charles le Maistre Memorial Fund

After dealing with the accounts (showing an income of 258,000 Sw.fr. and an expenditure of 242,000 Sw.fr.) the treasurer presented a statement on the contributions to the Charles le Maistre Memorial Fund. Fourteen countries had subscribed, producing a capital sum of 25,000 Sw.fr. The largest contributor was the U.K. with 5,000 Sw.fr., this sum having been collected through individuals in the electrical industry who had known and worked with le Maistre.

It may be recalled that the Charles le Maistre Memorial was instituted by the Committee of Action in 1953 when it was decided that it should take the form of a lecture to be given during the annual meeting of the I.E.C. The objects are to perpetuate the memory of the outstanding services given to the I.E.C. by le Maistre in the course of the 49 years during which he held the office of general secretary, and to contribute to the progress of international electrical standardization through the activity of the Commission. A note on this year's lecture by Mr. André Lange appeared in the *Electrical Review* of 15th July. The Committee agreed in principle that an American should be invited to give the lecture in 1956.

Mr. J. H. C. Spinks (Metropolitan-Vickers Electrical Co., Ltd.) was appointed as the new chairman of the technical committee on rotating machinery, in succession to Mr. C. A. Martin of the British Thomson-Houston Co., Ltd. A new technical committee on protective relays was set up with Belgium as secretariat: its work will be based on a report on relays drawn up by a study group of C.I.G.R.E. Another new technical committee, on high voltage techniques, was formed to draw up I.E.C. recommendations covering testing techniques related to impulse voltages and currents and to high voltages both a.c. and d.c. This new committee will take over some of the work hitherto done by the technical committee on insulators, the scope of which will now be restricted to insulators and related equipment. Sweden will act as secretariat for the new committee, the chairman being Mr. H. W. Puppikofer (Switzerland).

A proposal to set up a new technical committee on electric furnaces was submitted by Belgium, whose representative stated that the matter was also of interest to the Bureau

International d'Electrothermie. No decision on the matter was taken but the Committee of Action recorded its interest and requested the Belgian National Committee to raise the matter again when the study at present being undertaken by the Bureau International d'Electrothermie has reached an appropriate stage.

The Committee of Action confirmed the view recorded at Philadelphia last year that the preparation of appropriate I.E.C. recommendations covering the fundamental aspects of safety and like matters is a matter of urgency, and it was agreed that each of the technical committees concerned should be asked to expedite its work, particularly in relation to industrial low-voltage switchgear and electrical accessories. Note was taken of the fact that there is an increasing tendency for certification of safety features by manufacturers or independent bodies to be called for. This means that there is a greater necessity for co-ordinated national standards on which such certification can be based. A small working group was formed to keep an eye on the progress of this work.

In view of the increasing work relating to standardization in the field of electronics and telecommunications being carried out at present or which may be done in future by the I.E.C. and other interested bodies, it was decided to set up an Electronics and Telecommunications Advisory Committee for making recommendations to the Committee of Action on the general guidance and co-ordination of the work of I.E.C. committees on these subjects; liaison between the I.E.C. and other interested international bodies, such as the International Telecommunications Union; and the allocation of projects to appropriate I.E.C. committees as and when proposals are received.

The invitation from the German National Committee for the 1956 meeting to be held in Munich during the period 27th June-7th July, was accepted and an invitation for the 1957 meeting to be held in Madrid was noted with appreciation, a final decision regarding acceptance being held over until next year. India expressed the hope that a meeting might be held in that country in 1958 or 1959.

REPORTS BY TECHNICAL COMMITTEES

The work of the technical committees which met in London may be briefly summarized as follows:—

Technical Committee No. 2, Rotating Machinery. A sub-committee on losses and efficiency examined some proposals submitted by France on test methods for the determination of separate losses. A new draft will now be prepared for further consideration. When completed, this will form Section 10 of I.E.C. Publication 34, Rules for Rotating Electrical Machinery. The secretariat will prepare a new draft dealing with intermittent rating. It was not found possible to reach agreement on clauses dealing with wave-form irregularities, and the matter has been referred back to the National Committees. Consideration is also to be given to the question of impulse-voltage testing of rotating machinery, a matter on which there is at present no consensus of opinion.

Graphical Symbols

Technical Committee No. 3, Graphical Symbols. A list of basic symbols, equally applicable to power and telecommunication engineering, was approved for publication, while a list of symbols for resistance, inductance, windings, capacitors, machines and transformers was provisionally agreed and will be circulated to the National Committees under the six months' rule.

A joint committee with the International Union of Railways was decided upon in principle, and arrangements were made for liaison with other international bodies. Future work of this Committee will embrace symbols for instrument transformers, switchgear, relays, valves, rectifiers, and installation materials, etc.

"Standards" and "Specifications"

Technical Committee No. 7, Aluminium. During the past few years this Committee has met several times but progress has been slow, largely due to confusion during discussions between "standards" which are fundamental values (of resistance) without tolerance, and "specifications" which might include specified values subject to tolerances. The situation was clarified at the meeting in Philadelphia last year, when tentative agreement was reached on an international standard of resistance for aluminium, the standard value being 1/37 ohm mm^2/m.

This proposal gave rise to considerable criticism, however, on the grounds that it was too far removed from the resistance value met with in commercial practice. Consequently, at the London meeting the proposal was dropped and replaced by a "conventional value of resistivity of commercial hard-drawn aluminium wire" to be used for purposes of calculation. This figure is 0·028264 ohm mm^2/m.

Agreement was also reached on a specification for commercial hard-drawn aluminium wire, the maximum value for the volume resistivity being 0·02845 ohm mm^2/m. The density is to be taken as 2·703 kg/dm^3 (0·09765 lb/in^3), the constant-mass temperature co-efficient of resistance as 0·00403 per centigrade degree, and the co-efficient of linear expansion as 0·000023 per centigrade degree. For commercial aluminium busbars the maximum volume resistivity was agreed as 0·0290 ohm mm^2/m.

Agreement was reached on a specification for aluminium alloy wire of the Al Si Mg type containing approximately 0·5 per cent of Mg and approximately 0·5 per cent of Si. The volume resistivity shall not exceed 0·0328 ohm mm^2/m, the tensile strength shall be not less than 30 kg/mm^2, and the minimum elongation on a length of 200 mm after breakage shall be 4 per cent for wires of 1·50 to 4·50 mm diameter.

All these values are subject to confirmation by the National Committees under the six months' rule.

Technical Committee No. 12, Radio Communication. Most of the time at the London meeting was devoted to the consideration of methods of measurement on television receivers, and the resulting draft is now ready for circulation for approval under the six months' rule. There was also some discussion on the measurement of interference from broadcast receivers, but the existence of several different and not wholly satisfactory techniques of interference measurement in the various countries made it difficult to draw up an agreed specification. A committee of experts was therefore set up to devise a programme with a view to resolving the differences. In this work close liaison will be maintained with the CISPR (Special International Committee on Radio Interference). For the restricted sphere of measurement of interference from a.m. broadcast receivers and from the time bases of television receivers there is a greater amount of agreement, and after a further meeting it may be possible to draw up a document for general approval.

Good progress was made in completing a document on the measurements on f.m. receivers, a subject fully discussed in Philadelphia last year. A new draft will shortly be circulated under the two months' procedure for final approval. A sub-committee of Technical Committee No. 12 gave consideration to radio transmitters and decided

upon a programme of future work. This will include terminology, methods of measurement and testing, a standard range of powers and safety rules for service personnel at radio transmitters.

Technical Committee No. 16, Terminal Markings. The work of this Committee is of interest to several other I.E.C. Committees and the acceptance of its recommendations is therefore dependent on the necessary liaison being established. This can best be done at the national level, and within the B.S.I. this is achieved by means of a co-ordinating committee on terminal markings.

Good progress was made with regard to terminal markings for transformers and instrument transformers and with regard to identification markings for conductors. The decisions on these matters will be circulated for approval under the six months' rule. In the case of terminal markings for rotating machines there are two systems in general use for d.c. machines, and further discussion will be necessary before a decision can be reached in favour of the recognition of one or the other as the preferred standard. Committees of experts were set up to draft proposals for terminal markings for rectifiers and for auxiliary circuits.

Switchgear Studies

Technical Committee No. 17, Switchgear. The work of this Committee is done mainly in two sub-committees dealing with high-voltage and with low-voltage equipment respectively. Dealing first with the low-voltage equipment, the importance of this work was emphasized by the Committee of Action in relation to the general question of safety regulations, and in particular in connection with the electrical equipment of machine tools. Exports of machine tools are in many cases hindered by the adoption of different electrical clearances for the control gear in the various national prescriptions, and it was largely on this account that the sub-committee on low-voltage switchgear and control gear was set up. It was agreed at the meeting in London that two documents should be prepared by the secretariat (France), one for contactors and one for circuit-breakers.

For high-voltage switchgear there has for some years been an I.E.C. publication for circuit-breakers, but so far this has dealt only with rules for short-circuit conditions and rules for temperature rise under normal load conditions. Further sections covering rules for operating conditions and unit testing have now been completed for final approval, and a draft on rules for the strength of insulation will be circulated for provisional approval under the six months' rule. Subjects for future study include rules for rating and testing circuit-breakers with respect to the switching of line charging and capacity bank currents; measurement of the inherent re-striking voltages; co-ordination of rated voltages, rated breaking capacity, and rated normal currents; and a new basis for rating power circuit-breakers. A proposal on this last point will be prepared by the American National Committee.

Dry-Type Rectifiers

Technical Committee No. 22, Power Converting Equipment. Up to the present this Committee has been dealing mainly with mercury-arc rectifiers, but now that work on this subject has been practically completed as the result of the meeting in Philadelphia last year attention is being given to dry-type (semi-conductor) rectifiers. Sweden had prepared a draft specification and it was decided to review this from the standpoint of the well-established types of rectifier (selenium, copper oxide, etc.), and to consider later the extent to which the draft could be widened to cover the new single-crystal semi-conductors (e.g., germanium, silicon). The discussion at this meeting was concerned mainly with principles rather than details, and as a result the secretariat will prepare a revised draft for consideration at the next meeting.

Technical Committee No. 23, Electrical Accessories. This Committee is working in close liaison with the International Commission on Rules for the Approval of Electrical Equipment (the C.E.E.), and in fact the president of the C.E.E., Professor J. C. van Staveren, is also chairman of the I.E.C. Committee. At the London meeting the main item for discussion was a specification for Edison-screw lampholders. Such a specification has already been published by the C.E.E. but it is already due for revision in certain details and it is hoped that as a result of the present discussions a joint I.E.C./C.E.E. specification can be produced.

Domestic Plugs and Sockets

The topic of plugs and sockets is always with us, both nationally and internationally, and will no doubt come up again and again, but a definite step was reached at the London meeting when final approval was given to a specification for domestic plugs and sockets. This specification deals with three main groups of plugs in general use, these corresponding to the American, British and Continental patterns respectively. The three groups are not interchangeable with each other, but within each group the dimensions essential to secure interchangeability and to ensure safety are given. The foreword to the specification stresses the desirability of any one country adopting only the standards belonging to one of these groups.

That the subject is by no means finally disposed of, however, is shown by the fact that Switzerland is not satisfied with the present Continental design of domestic plug and socket. This country put forward proposals for modifications (to be brought into use gradually) with a view to ensuring that plugs fitted to appliances intended for earthing cannot be inserted in sockets which are not earthed. These proposals are to be given further consideration.

Technical Committee No. 28, Co-ordination of Insulation. Several additions and amendments to I.E.C. Publication No. 71, Recommendations for Insulation Co-ordination, were agreed upon for circulation under the six months' rule. It was also decided to proceed with the drafting of an Application Guide, this being in the nature of a code of practice. In this work there will be collaboration with the C.I.G.R.E.

Technical Committee No. 33, Power Capacitors. The main items of discussion were specifications for series capacitors, shunt capacitors to be used under tropical conditions, and medium-frequency capacitors. For series capacitors the secretariat (Holland) had prepared a draft on the basis of a questionnaire sent out after the Philadelphia meeting last year. Agreement was reached on many of the points in this draft but some matters had to be referred back to the National Committees for further consideration.

The draft specification for tropical capacitors was based on data submitted by India relating to the maximum temperature conditions prevailing in tropical countries. This draft, which will eventually be issued as Part 3 of I.E.C. Publication 70, Power Capacitors, is now ready for circulation under the six months' rule.

The position regarding medium-frequency capacitors (e.g., for use with m.f. furnaces) is that provisional agreement has been reached on definitions, safety requirements and tests, but consideration of the section giving guidance

on application and operation had to be deferred till the next meeting.

This committee also raised the general question of the terminology used to describe various kinds of tests such as type tests, routine tests, sampling tests and acceptance tests. A proposal was submitted to, and accepted by, the Committee of Action that the terminology used in this connection by the various I.E.C. committees should be co-ordinated.

Technical Committee No. 36, Insulators. After consideration of the comments received under the two months' procedure regarding a draft specification for glass insulators for high-voltage overhead lines an editing committee was instructed to prepare a revised draft for publication. A draft specification for bushing insulators was completed for circulation under the six months' rule. A draft on ball and socket fittings for suspension insulators was discussed and referred back to the National Committees for further examination.

Several documents dealing with high-voltage testing and measurement techniques were discussed, but future work on these subjects will be done by the new Technical Committee on High-Voltage Testing Techniques, as mentioned earlier in this report.

Technical Committee No. 37, Lightning Arrestors. A draft specification for valve-type arrestors was completed for circulation under the six months' rule, and work will now be started on a specification for expulsion-type arrestors.

Technical Committee No. 39, Electronic Tubes and Valves. A new section of I.E.C. Publication 67, Radio Valve Bases, has been approved for publication, this new section dealing with the duodecal (12-pin) base. An American proposal for a new type of base, and a Netherlands proposal for a new outline for the small button noval (9-pin) base were provisionally accepted for circulation under the six months' rule. A document on dimensions of sub-miniature outline gauges was agreed for circulation under the two months' procedure for final approval.

A committee on valve sockets was set up jointly with Technical Committee No. 40, Electronic Components, and this new committee has been requested to consider also the standardization of accessories for valves, such as cap connectors, screens or shields, retaining devices, etc.

Technical Committee No. 40, Electronic Components. This was the first meeting of this new committee, and its first item was to define its scope. The proposal, which was subsequently endorsed by the Committee of Action, was that the committee should be responsible for the preparation of recommendations for components to be used in equipment for telecommunication and similar techniques, including high-frequency cables and connectors, but excluding semi-conductor devices, rectifiers and all types of electronic tubes and valves—these items all being the responsibility of other I.E.C. committees.

The committee then split up into sub-committees which later presented reports as a result of which two specifications were approved for publication, dealing respectively with fixed paper capacitors for d.c. (including a colour code) and with rated characteristic impedances and diameters of radio-frequency cables. In addition, three specifications were approved for circulation under the six months' rule, dealing respectively with receiver-type metallized mica capacitors, fixed carbon composition resistors, and general requirements and methods of measurement for r.f. cables.

Arising out of the work of this committee consideration is to be given on a broader basis to the co-ordination of colour coding as applied to various types of equipment. The Netherlands will prepare a statement on the present position in order that the scope of the problem can be assessed.

Large Forging Press

A NEW 2,000-ton, four column press has recently been installed at the Renfrew works of Babcock & Wilcox, Ltd., to assist in the production of boiler drums. Up to now the ends of the steam drums have been pressed in the forge department and machined in the main machine shop. The largest press hitherto available for this particular work has been one of 480 tons, which has involved multi-stage pressing operations for the thicker plates. The new press will enable drum ends of any size so far envisaged to be easily handled and should be of considerable assistance to the future programme in atomic power plant. The press, together with a bogie type furnace, is installed in the forge department and vertical boring mills for machining the pressings are in an adjacent bay.

When this new press was first contemplated it was realized that if a conventional design were used it would require a much larger building than the present forge. This would have meant that the existing crane could not be used over the entire length of the shop and, in addition to the extra building height, would have necessitated a second crane which would, of course, have been restricted to the immediate area of the press.

To keep the head-room down, the press is of the moving-column type which, in effect, gives an inverted arrangement. The lower die, instead of being raised on a ram, is on a fixed table at floor level, and the moving die is attached to the upper bolster, to which are attached the main columns of the press. These pass through the table and are attached at their lower ends to a second heavy steel bolster, upon which the hydraulic cylinders act. All this part, of course, is below floor level. In order to accommodate a press of this type a very deep foundation pit had to be provided and, although the overall height of the press above the shop floor is only 18ft 9in, the foundation pit is some 40ft deep and very nearly the same in diameter.

Since the water table at this part lies between 15 to 20ft below the surface the sinking of a foundation pit of this type proved a major problem in civil engineering. This part was carried out by Balfour, Beatty & Co., Ltd., and required the employment of a diver for about half the depth of the excavation and the placing of a concrete plug at the bottom. This plug alone amounted to some 450 cu yd of concrete.

The press itself was designed and built by Fielding & Platt, Ltd. It will take the heaviest plate rolled with a maximum width of 12ft 6in and is suitable for pressing drum ends from 12ft 6in circular blanks 7in thick. The pressure is applied by two main rams and four auxiliary rams arranged in a square, with two draw-back rams to raise the moving portion. For feeding work in and out there is a sliding table operated by two hydraulic cylinders with a stroke of 12ft 6in and a combined power of 50 tons.

The entire control of the press and sliding table is from a desk type control panel adjacent to the press, the main hydraulic valves being servo-operated. The power supply for the press is taken from the existing hydraulic mains operating at 1 ton/sq in. The press is associated with an oil-fired furnace supplied by the Dowson & Mason Gas Plant Co., Ltd., for plate heating service and it is proposed to install an additional furnace at a later date.

Temperature Controls

A Review of Electrical Methods

By J. RUSSELL HICKMOTT, A.M.I.B.A.E.

THE rising cost of fuel in recent years has emphasized the need for economy and has brought about a rapid development of automatic control devices which aid its efficient use. In the forefront of these advances electrically operated controls have held a major position. The conventional types of equipment have progressed from the simple bi-metallic thermostat giving on/off control to modulating and proportioning instruments while, more recently still, electronic techniques have been applied to some of the complex problems of air conditioning.

The installation and wiring of these specialized controls is usually carried out by the electrical contractor and there is an increasing demand for experienced firms to undertake the work. It would be untrue to suggest that the circuits involved are simple and, most important of all, the final test of the wiring does require some knowledge of the function of the controls themselves. A general consideration of some of the electrical features will, therefore, be of interest.

Potentiometric Controls

There is a wide range of temperature control circuits based upon the conventional Wheatstone bridge. The basic purpose of these instruments is to give a proportioning action and they are applied to the control of electric, hot water and steam heating. In the case of electric heating the final control is usually a series of steps by which contactors are opened or closed in sequence to bring into circuit more or less heating element according to the heat demand. The step controller is driven by a reversing motor which is positioned by a temperature controller and it is this part of the circuit which is potentiometric. It will be appreciated that the motor unit can also be used to position a steam or hot water valve. The essential part of the circuit is, therefore, common to the three forms of heating.

Consideration of Fig. 1 will make clear the essential arrangement of the circuit. The moving contact of the potentiometer in the temperature controller is set by means of a bellows unit sensitive to temperature change. As actually drawn in the diagram the bridge circuits are balanced. If a change of temperature occurs at the controller the sliding contact will move from its central position. We will assume that it moves towards terminal F. Immediately this occurs the bridge will be out of balance and more current will flow through coil B of the balanced relay than flows through coil A. The armature of the relay will, therefore, be deflected and one winding of the reversing motor energized. Because the moving contact of the motor potentiometer is connected through gearing to the motor shaft and so arranged that it moves in the opposite sense to the controller sliding contact the motor will only continue to run until the circuit is again balanced. A change of temperature of opposite value will clearly cause the other motor winding to be energized.

Two other points should be noted. Firstly, the motor operates at line voltage while the control circuit is at low voltage, usually 24 V. Secondly, reversing the wires connected to terminals G and H or E and F will reverse the operation of the system. That is, if a rise in temperature gives a certain movement of the motor unit with straight connections, crossed connections will give a reverse operation.

Modulating Control

A further method of continuously relating the movement of a motor unit is by means of a three position thermostat. The basic arrangement of this circuit is shown in Fig. 2. The moving arm of the thermostat is positioned by the bellows unit so that at the required temperature it is in the mid off position. A rise or fall in temperature causes it to "make" on either terminal A or B. The motor unit is thereby energized and continues to rotate until the thermostat is satisfied and its contact arm returns to the mid off position. At the full travel in either direction limit switches (shown at C and D) mechanically connected to the motor gearing break the motor circuit.

It will be obvious that a simple arrangement of this type has only a limited application. For example, unless the thermostat response is extremely rapid the motor will run to the limit of its travel with every operation. In practice an adjustable time switch is included in the circuit so that the response rate can be related to the characteristics of the system under control. If the normal response is relatively slow and under certain conditions (such as starting up when cold) a rapid operation is required a further set of contacts come into operation. These high-speed contacts are shown at A in Fig. 3 which illustrates

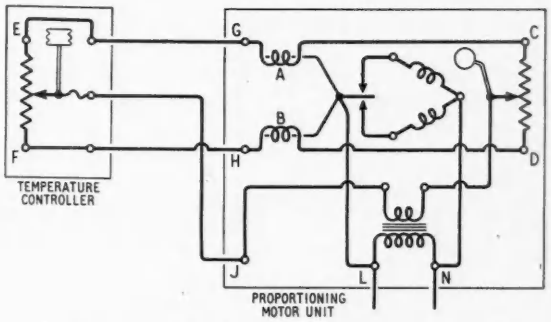


Fig. 1.—Basic circuit of proportional temperature controller

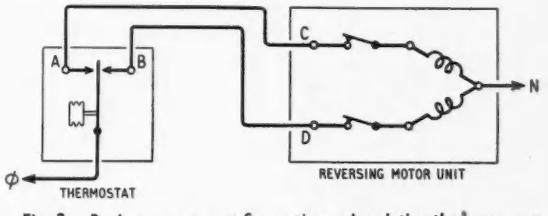


Fig. 2.—Basic arrangement for continuously relating the movement of a motor by means of a three position thermostat

the practical circuit. In effect these contacts override the time delay device until conditions return to normal.

The timer has two sets of contacts in series so arranged that the period during which both of them are closed is adjustable. Thus, when the thermostat senses a demand in excess of normal its moving contact makes on the high-speed contact and one of the timer contacts is eliminated from the circuit. This increases the time during which the motor is energized and so effects a more rapid movement.

Electronic Controls

To overcome the limitations imposed by mechanical factors which reduce sensitivity where relatively large currents have to be handled by the thermostat contacts a special type of instrument has been introduced. If the duty of the thermostat contacts is limited to a few micro-amps at a fraction of a volt the contact gap and length of stem can be considerably reduced. This has been achieved by using the thermostat to trigger an electronic amplifier. The cost of the complete equipment is higher than for a standard thermostat but where the practical requirements call for a very small sensing element or high sensitivity it provides a satisfactory answer.

More complex types of electronic temperature controls have been evolved with special application to large air-conditioning plants. The temperature sensing elements consist of a wire wound resistance element, normally of 500 ohms, housed in either a wall, immersion or duct mounting and having a temperature response of 1·2 ohms per deg F. A typical application would be the use of two such elements in an inside/outside compensator circuit arranged to control the flow temperature of a heating system as a function of outside temperature. Electrically the outside element would be included in one arm of a bridge circuit with the flow temperature element connected in an opposing arm.

A galvanometer connected in the conventional manner in the bridge will indicate an increase in either inside or outside temperature and if the circuit is suitably adjusted it can be arranged that for every degree rise in outside temperature there must be a fall in flow temperature to again balance the bridge. It will also be evident that the ratio of outside temperature change to the corresponding change of flow temperature is a function of resistance values and can be varied as required. In a practical equipment the galvanometer is replaced by an electronic amplifier to magnify the signals sufficiently to energize a pair of relays operating as a change-over switch, the relay being included in a conventional motorized circuit as described above.

Flame Failure Control

Electronic controls are also frequently used for the automatic control of gas or oil fired boilers. A practical application is flame failure control and the equipment is either photo-electric or flame conductive in operation. Fig. 4 shows a typical arrangement. The function of the circuit is to maintain temperature control and to automatically shut off the gas supply in the event of flame failure. It should be noted that the start button is so arranged that the main gas valve cannot open until the button is released. This gives the operator full control of the starting sequence. Immediately the pilot flame has been established by manual ignition and makes contact with the flame electrode the electronic amplifier is energized by the flame circuit and the relay makes contact. This provides a hold-in circuit for the pilot valve and energizes the main gas valve circuit in series with the thermostat and the back contacts of the push button. Therefore, so

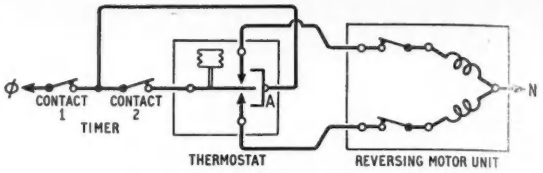


Fig. 3.—This arrangement incorporates a timer to allow the response rate to be related to the characteristics of the system under control

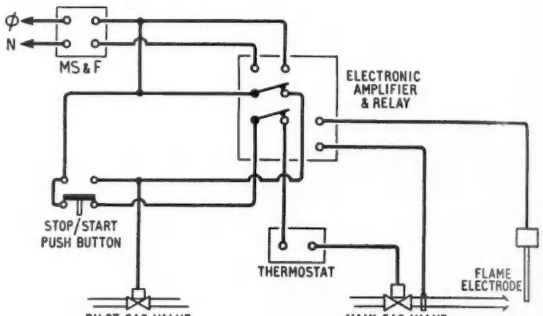


Fig. 4.—Essentials of a flame failure control equipment. (Circuit shown for the running position)

long as flame is maintained the main burner is under the control of the thermostat.

A similar circuit is used for the control of an oil burner, the flame electrode being replaced by a photo-electric cell. The operating relay is maintained in the "run" position by the amplified current originating in the photo-cell when it is subjected to flame luminosity. A recent type of photo-cell equipment utilizes the lead sulphide cell and the electronic circuit is designed to differentiate between the fluctuating infra-red component of the flame and the steady radiation from glowing refractory. This equipment is suitable for controlling either gas or oil burners.

Iron and Steel Institute

THE Council of the Iron and Steel Institute has accepted an invitation from the Lincolnshire Iron and Steel Institute to hold a special meeting in Scunthorpe from 12th to 14th October next, inclusive. During the Wednesday and Thursday mornings the following papers will be presented and discussed: "Developments in Ironmaking at Appleby-Frodingham," by G. D. Elliot, O.B.E.; "The Expansion Scheme at John Lysaght's Scunthorpe Works, Ltd.," by W. L. James; "Steelmaking at Redbourn," by S. R. Isaac; "Organization for Maintenance," by J. L. Gaskell; "Underground Mining of the Frodingham Ironstone Bed at the Dragonby Mine, Scunthorpe," by C. Smith; and "Development of Chemical Methods for the Treatment of Low-Grade Ores at Appleby-Frodingham," by L. Reeve.

A programme of visits to works and ore mines has been arranged for members on the Wednesday and Thursday afternoons, and for members and ladies on the Friday morning. There will be all-day visits for the ladies to places of general interest on Wednesday and Thursday. The programme also includes evening functions on the Wednesday and Thursday.

All members wishing to take part in the meeting are asked to complete the form of registration, obtainable from the Secretary, Iron and Steel Institute, 4, Grosvenor Gardens, London, S.W.1, and return it by 31st August at the latest.

INDUSTRY AND THE HOUSE

By A. M. F. PALMER, A.M.I.E.E., M.P.

THERE was a more than usually full House for the fuel and power debate when Mr. Geoffrey Lloyd rose to defend the Government's policy, which had been previously heavily criticized from his own back benches. However, it was soon obvious that the Minister had now recovered completely from the apologetic tendencies of several earlier question times.

The fact is, I think, that Mr. Lloyd has sensed well enough that fuel and power do not admit of any really deep clash. Apart altogether from the gritty practical nature of the subject itself, restless Conservative critics are more than cancelled out by others who know that there are limits to which the Minister can be decently driven since many of his ideas are bound to be worked out in conjunction with the Coal Board and the Mine-workers' Union.

He did not deny, of course, that there was a fuel battle ahead which would not be easy to win. Yet, Mr. Lloyd claimed, the Government did not lack a plan for the campaign. The Coal Board had been reorganized; a tremendous nuclear energy programme was under way; and the oil industry was likely to save the country at least 250 million tons of coal over the next decade. Nor did Mr. Lloyd apologize for the price increases, although some unsophisticated Members found difficulty in making up their minds as to whether it is really true that dearer coal represents progress because it allegedly results in fuel economy, or whether it is not simply another indication that Britain is incapable of stabilizing the cost of living. The contradiction in running imports in parallel with an export programme was partially resolved by Mr. Lloyd's statement that the Government had reached the reluctant conclusion that we must in future not sell so much coal overseas but use it at home.

Finally, the Minister bravely defended the N.C.B. and the mining industry against its attackers. He reminded the House that from the day the last war broke out there had been no respite in the constant struggle to remedy fuel shortages; on top of all, the industry had been struggling to renew itself. The coal industry really did now need "a breathing space."

Opposition Amendment

Mr. Philip Noel-Baker, the ex-Minister of Fuel and Power, moved the official Opposition amendment, which, after expressing appreciation of the efforts of the miners, condemned the Government for its failure to pursue "a vigorous fuel efficiency policy" and demanded that the financial loss on coal imports should no longer be carried by the Coal Board.

Mr. Noel-Baker said the Government was facing serious difficulties as the Opposition had foreshadowed four years ago, but their warnings had been ignored. He did not accuse the Minister, but Conservative back-benchers and the Conservative organization in the country who attempted to tell the nation that the lack of sufficient coal to meet the rising level of productivity was the fault of nationalization. Language of this kind created bitter feelings among the miners, because output per man-shift at the coal face was the highest ever. This output had been achieved with 75,000 fewer men than in 1938 and with 40,000 on development and special duties.

On fuel efficiency Mr. Noel-Baker said the Government was investing £350 million in nuclear energy to save the equivalent of £5 million of coal. If it would only invest one-tenth of that amount in fuel saving it would obtain quicker results. The burden of imports on the National Coal Board could be lightened by allowing large importers such as the Central Electricity Authority to make their own coal purchases abroad.

The debate was continued by a succession of speakers from both sides of the House, mostly informative and constructive. It must be confessed that although Mr. Nabarro made an eloquent and competent speech, both sides of the House made no attempt to conceal their enjoyment when it became evident that the bark of the Hon. Member for Kidderminster was much stronger than his bite. Mr. Nabarro said there had been speculation about the way in which he would vote, but he would vote with his party and no nonsense. The whole thing was, I am afraid, a little tame; after all, only two short weeks ago Mr. Nabarro had described Mr. Lloyd's efforts as constituting only "a so-called fuel and power policy."

Technical and Scientific Education

Wednesday's fuel debate was followed on the Thursday by a special discussion initiated by Mr. Albu, Labour M.P. for Edmonton and a chartered engineer, on technical and scientific education. Sir David Eccles, the Minister of Education, is a smooth front bench performer. He said this time it would be a "crime against civilization" to spend vast sums on expanding the kind of education which taught people how to produce wealth if at the same time we were not prepared to spend money on the kind of education which taught them how to enjoy wealth. Bold plans were needed and the Government hoped to make a fuller statement before Christmas. The intention was to construct a broader route for the training of the technologists than that which now led to the universities. All boys and girls would be given opportunity to go as far as their abilities and enterprise would take them with the assurance that there would be plenty of entrances and exits at every stage. It had long been clear that the "sandwich" course was the most promising line of development. Boys leaving school at 18 with the General Certificate of Education, together with those who had left school earlier and had kept on their studies at technical colleges, would spend six months at college and six months in the works over say four or five years. Sir David believed this was a peculiarly "British compromise" between "earning and learning."

The Minister stated that the Government had accepted the recommendations of the National Advisory Council on Education for Industry and Commerce that a new technological award should be instituted. Lord Hives, chairman of Rolls-Royce, Ltd., would act as chairman of the new award-making Council. In a reference to the doubts of the engineering Institutions Sir David said that some people had misunderstood the position, which was probably his fault. They had not appreciated how

completely free the awarding Council would be to set high standards. He hoped that the new regional colleges when established would divest themselves of lower grade work, which could be passed to local satellite technical colleges.

Although the House was thinly attended, a combination of Members with experience in teaching and industry kept the course of discussion running until 10 o'clock, when Mr. Henry Brooke, Financial Secretary to the Treasury, replied, devoting much of his time to the probable cost of the proposed programme.

LETTERS TO THE EDITOR

Letters should bear the writers' names and addresses, not necessarily for publication. Responsibility cannot be accepted for the opinions expressed by correspondents.

Domestic Hair Dryers

IT is interesting to peruse the useful list of hair dryers in the 22nd July issue of your journal. It would seem that from the user's point of view these can be divided into three categories: (a) those which have a.c. motors and cannot cause radio and television interference; (b) those which are "suppressed" to some extent and (c) those which the makers apparently don't care whether they interfere or not.

There is only one category which cannot cause interference—that with the a.c. induction motor, and I am glad to see that one of our foremost manufacturers has had the courage to concentrate on the a.c. market and thereby make an article which is more robust yet less expensive. With the latter in mind, particularly as far as our contractor friends are concerned, it is to everyone's advantage to push the sale of the a.c. variety.

Broxbourne, Herts. T. L. FRANKLIN.

Current Transformers

REFERRING to Mr. J. H. Toule's contribution in the *Electrical Review* of 15th July, I agree with his remarks regarding the desirability of the current output wave-form of the test set providing current for commissioning protective gear being sinusoidal, particularly in the case of protective gear employing induction pattern relays, but I would point out that it is not necessary to employ a series resistance to achieve this object.

A considerably more effective method is to employ a 50 c/s tuned circuit in series with the test circuit to form a high impedance to the harmonic components; this has the effect of more nearly simulating circuit conditions at the time of fault. A protective gear test set, manufactured by Foster Transformers, Ltd., incorporates such a circuit with a matching transformer designed to keep the voltage in the test circuit to a minimum.

Nacton, near Ipswich. L. B. S. GOLDS.

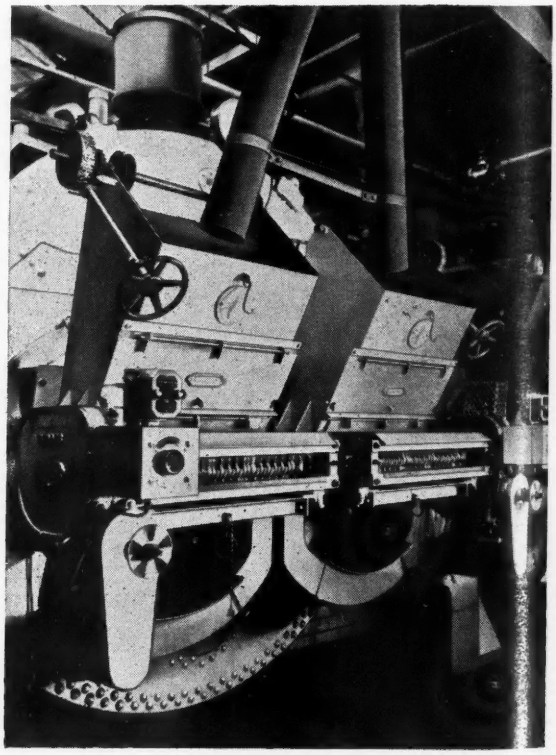
Mining Electrical and Mechanical Engineers

AN address entitled "Whither Our Steps?" prepared by the late Mr. H. Brocklesbury as president-elect of the Association of Mining Electrical and Mechanical Engineers, was to have been presented by Mr. B. L. Metcalf (national president) at the Association's annual convention, which was cancelled on account of the railway strike. Its main theme was the desirability of following up the statutory recognition in 1954 of the Association Certificates by obtaining a Royal Charter. The requirement for statutory qualification of members, technically and by practical experience, was believed to be the first of its kind to relate to manual workers. The term "technician" was considered apt to describe men who were skilled, trained and educated and was one that would probably be more widely used in its correct sense than was the word "engineer." Since there was no specific dividing line between the professional engineer and the technician, the expression "technical engineer" was suggested as appropriate to cover the range catered for by the Association. A previous petition for a Royal Charter was dismissed in 1947, when counter-petitions were presented by the three senior engineering institutions. Since then new articles of association had been drawn up and the status and organization of members had been improved. As the Certificates were now being approved by the Mining Qualifications Board, this should remove any further objections as regards examinations and educational qualifications on the part of the senior institutions.

New Chain Grate Stoker

THE introduction of the latest model in their range of mechanical stokers—the Mark III chain grate stoker for shell type boilers—is announced by Bennis Combustion, Ltd., Little Hulton, Walkden, Manchester.

Three "Marks" have now been produced since 1949, each introducing improvements dictated by operational experience. This latest model, whilst retaining the original robust chain grate links on which there is now a three years' fair wear and tear guarantee, includes a hopper of streamlined appearance and lighter construction and which is easier to remove. It also eliminates any possibility of coal stagnation and subsequent "firing back." The ignition arch is now supported by "Carbofrax" bricks, and improvements have been made in air distribution within the chassis. Forced draught fans can be erected overhead or at firing floor level according to choice. The first installations of this machine have now been completed.



Bennis Mark III chain grate stoker

VIEWS on the NEWS

By REFLECTOR

DURING a visit the other day to a well-known cable works I saw in the yard substantial quantities of coils of copper. I suggested that what is now a semi-precious metal should be kept under lock and key and one of my hosts agreed that copper was now an extremely valuable material. He jokingly compared it with silver, which reminded me of the wartime use of silver in lieu of copper for busbars in the United States. The metal was only lent to electrical manufacturers and I presume that by this time it has been returned to the United States Treasury. Copper was then of more importance than silver although in terms of price silver remained much dearer—surely a reflection upon our ideas of comparative values. I am not suggesting that the price of copper should be raised above that of silver. Although copper costs about six times what it did in 1945 it is still possible to obtain about a couple of pounds of it for the price of an ounce of silver.

* * *

The Stratford-on-Avon Town Council is again protesting against the erection of overhead lines in its area. At a recent Ministry of Fuel and Power inquiry into an application by the Midlands Electricity Board for sanction to the erection of overhead lines to supply certain villages the Town Clerk said that they did not wish to deprive anyone of the benefits of electrical service but they deprecated the continued erection of overhead lines which were detrimental to the appearance of their historic town. One member of the Council, Alderman J. H. Rowe, did not agree with the protest. He is a farmer and went so far as to say (according to the *Stratford-upon-Avon Herald*):—"If we cannot have electricity we can only stop farming. We are finished." I had not realized that electricity was as indispensable to farmers as this.

* * *

When it is expected that all the Electricity Boards will have to put up their charges as a result of the steep rise in the cost of coal it is pleasing to hear from Mr. C. T. Melling, the chairman, that the Eastern Board is hopeful of avoiding increased prices. Apparently some allowance was made for such a contingency when the Board raised its charges earlier this year. Another body which proposes to keep its prices at the present level is the Douglas (I.O.M.) Corporation. The Electricity Committee believes that this decision is justified by the "hope of a substantial contribution towards the increased cost by a further development in the use of electricity." It is only fair that I should add that the Douglas Gas Light Co. has made a similar decision so far as its gas is concerned although it is to charge more for its coke.

* * *

Mr. A. G. Bullen (Broadgreen) raises a nice point in a letter to the *Liverpool Daily Post* commenting upon proposed electricity price changes in the Merseyside area. The question whether an increase in the price of coal justifies the enlargement of electricity bills by the same percentage as coal is only one of the many items entering into the cost of electricity to the consumer. He agrees that some increase in the running (or "unit") charge is equitable but deprecates any raising of the standing charge. The Electricity Boards generally agree with this and some of them have specifically said that their standing charges will not be increased. But what is the position when this charge is embodied in the first step of a block tariff? It is Mr. Bullen's contention that there is no justification for any increase in the price of the basic units, but of course there is a certain element of running cost in this price. Strict equity in this case is a bit difficult.

* * *

Two Electricity Boards have become involved in different ways in the ice rink business. The South of Scotland Board has just acquired the Dunfermline Ice Rink. It is not intended that the Board shall enter the entertainment business or even stage cooking demonstrations on ice (there have been stranger shows than this). The rink is to become the main stores in the Fife Area, with garages, etc. The scene of the other case is Exmouth, Devon, where, the *Western Morning News* reports, residents have complained of the noise from a local recreation ground. A Mr. H. J. Graves told the Exmouth Urban Council that recently an ice show was housed on the ground. Its diesel engine broke down and so the proprietors hired a generator from the South Western Electricity Board—a "brute of a thing," said Mr. Graves. "It was jacked up and gave out a terrible noise all night." Perhaps the proprietors would have done better to go to the C.E.A. which specializes in generators.

* * *

Fifty years ago the *Electrical Review* felt compelled to congratulate the proprietors of *Tit Bits* upon the profundity of the knowledge of their science editor. From this gentleman's instructive notes the *Review* of 4th August, 1905, quoted the following:—

> "Have you never wondered how, when a wire is broken or damaged, say, between London and Birmingham, or between England and Ireland, the operator, sitting in his office, can tell exactly where the accident has occurred? The explanation is very simple. It requires force to send electricity through a wire. The longer the wire is, the greater is the force required. This force is measured; but, instead of calling it pounds, as in measuring the pressure in a boiler, electricians call the units of electrical force 'ohms.' Suppose a wire between two offices is 150 miles long, and that, on a stormy night, it gets broken somewhere. The telegraphist knows that when the wire was sound it took just 2,100 ohms to send a current through, or 14 ohms per mile. He now finds that he can send a current with only 700 ohms. He divides 700 by 14, and finds that the break in the wire is 50 miles from his end."

PERSONAL AND SOCIAL

News of Men and Women of the Industry

At the recent annual general meeting of the British Internal Combustion Engine Research Association **Viscount Falmouth** was re-elected president. **Sir Harold Roxbee Cox, Dr. S. F. Dorey,** chief engineer surveyor, Lloyd's Register of Shipping, and **Vice-Admiral Sir Frank Mason,** Engineer-in-Chief of the Fleet, were re-elected vice-presidents, and **Brigadier H. P. Drayson,** Director, Royal Engineer Equipment, Ministry of Supply, was elected a vice-president. **Mr. V. H. Hopkins** and **Mr. A. C. Yeates** were elected to the Council, and **Mr. J. Calderwood** has been elected by the Council as chairman.

Johnson & Phillips, Ltd., announce the following new appointments within their organization, to date from 1st August.

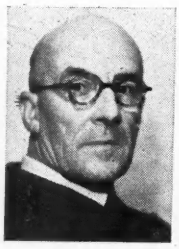
Mr. H. J. Olley has been appointed cable works manager responsible for both the rubber cable and paper cable works. Mr. Olley joined the Cable Department of J. & P. in 1918 and later was made manager of the Cable Cost Department. In 1940 he also undertook control of the newly-formed Employment and Welfare Department. For many years he has been a member of the Joint Industrial Council for the Cable Making Industry. In his new post Mr. Olley will be assisted by **Mr. B. C. Brown** and **Mr. W. Mann,** both of whom have held senior posts in the Cable Department. Mr. Brown becomes assistant manager of the rubber cable works and Mr. Mann assistant manager of the paper cable works. **Mr. F. J. C. Holliman,** who was previously assistant to Mr. Olley in the Employment and Welfare Department, has been appointed manager of this department, and **Mr. E. A. Twine** has been promoted to manager of the Cable Cost Department. In addition to these appointments, **Mr. C. E. Collar,** A.M.I.E.E., has been made assistant manager of the Transformer Department, and **Mr. H. West** assistant manager of the Cable Estimating Department.

Mr. H. J. Olley

Mr. B. C. Brown

Mr. W. Mann

Mr. F. J. C. Holliman



Mr. E. A. Twine

Mr. C. E. Collar

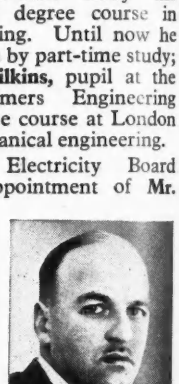
Mr. H. West

Mr. D. E. Lambert, B.Sc.(Eng.), M.I.E.E., Mem.A.I.E.E., has been appointed manager of the switchgear division of the Brush Electrical Engineering Co., Ltd., Loughborough, from 1st October. For the past thirty years Mr. Lambert has been with A. Reyrolle & Co., Ltd. He has held several senior appointments, including assistant technical manager of the company, and is at present engineer-in-charge of technical co-ordination and manager of the British Short Circuit Testing Station, Ltd. Mr. Lambert is well known nationally and internationally in connection with switchgear standardization.

Mr. E. Bruce Ball, C.B.E., has been appointed an additional director of Metal Industries, Ltd. Mr. Ball was formerly managing director of Glenfield & Kennedy, Ltd.

The first awards have now been made under the scholarship scheme announced by the General Electric Co., Ltd., two months ago. These scholarships are awarded annually to people of outstanding promise within the G.E.C. organization to provide for degree courses, post-graduate research, courses in specialized subjects and studies in management or commerce. From the twenty-eight applications received this year scholarships have been awarded to the following:—**Mr. D. M. Leakey,** graduate apprentice at the Coventry Telephone Works, for research at the Imperial College of Science and Technology on advanced aspects of communication theory; **Mr. D. N. L. La Frenais,** student assistant at the G.E.C. Research Laboratories, to complete by full-time study the final year of his degree course in electrical engineering. Until now he has been doing this by part-time study; and **Mr. L. J. Wilkins,** pupil at the Fraser & Chalmers Engineering Works, for a degree course at London University in mechanical engineering.

The Eastern Electricity Board announces the appointment of **Mr. R. W. J. Benyon,** M.I.E.E., A.I.I.A., as manager of the Essex Sub-Area in place of **Mr. R. H. M. Barkham,** B.Sc.(Eng.), M.I.E.E., who, as we recently reported, has been appointed the Board's chief commercial officer.



Mr. R. W. J. Benyon

Mr. Benyon was educated at Aylesbury Grammar School, and received his early technical training in the Electricity Department of the Aylesbury Corporation. From 1933 to 1948 he held various technical and commercial posts in the electricity supply industry at Barking, Colwyn Bay, Basingstoke, Beckenham and St. Helens. When the industry was nationalized in April, 1948, Mr. Benyon was appointed local manager of the St. Helens and Warrington Districts of the Merseyside and North Wales Electricity Board. In 1949 he was appointed manager of the Eastern Electricity Board's Romford District and in 1953, when the Romford and Brentwood Districts were merged, he became manager of the South-West Essex District, which appointment he has held up to the present time.

Cable & Wireless, Ltd., announces that **Major-General Sir Leslie Nicholls,** K.C.M.G., will relinquish the post of chairman of the company as from 31st January next, in order to devote his time to outside interests. Sir Leslie announced his intention to retire from office at the annual general meeting of the company held on 27th July but agreed to continue in office for another

six months, in order to give time for the appointment of a successor. He joined the court of directors in 1947, was appointed managing director in 1950 and chairman in 1951.

Mr. J. Clement, B.Sc., M.I.E.E., who recently relinquished the managership of the Birmingham office of the British Thomson-Houston Co., Ltd., has now been appointed assistant manager, home sales, at the company's head office, Rugby. After graduating at Glasgow University in 1926 Mr. Clement completed his engineering apprenticeship with the B.T.H. Co. at Rugby in 1928. This was followed by experience on outside construction in the London area, leading to an appointment at head office in the Industrial Machines Department. Mr. Clement was then posted to the Newcastle-on-Tyne branch in 1929, where he was largely engaged in dealing with the d.c./a.c. and 40/50 c/s changeovers; he was appointed manager in 1936. While in Newcastle Mr. Clement was for some time on the local Centre I.E.E. Committee and served as chairman of the E.I.B.A. Local Advisory Committee. During the last war he was called upon to organize the D.I.E.E. on the North East Coast for the Machine Tool Control Section of the Ministry of Supply. In December, 1946, he was transferred to the Birmingham office as manager.

Mr. J. Clement

Mr. J. Russell Hickmott, who writes in this issue on electrically operated temperature controls, is technical director of the Scientific and Engineering Advisory Service. He was educated at Rutlish School, Merton Park, and the University of London, and he received his works and practical training with the English Electric Co., the Foster Engineering Co., and the Hotpoint Electric Appliance Co., and later he was assistant consumers' engineer with the former London and Home Counties Joint Electricity Authority. During the war he was with the Admiralty, working on the firing equipment of magnetic and other electrically operated explosive mines. Subsequently he held positions in the engineering department of the Rheostatic Co. and as area manager with the Cornwall Power Co.

Mr. J. Russell Hickmott

At a farewell gathering on 27th July **Mr. M. J. Mortimer,** M.I.E.E., Worthing district manager of the South Eastern Electricity Board, was presented with a set of golf clubs by Mr. Davis on behalf of the district employees to mark his retirement after fifty years' service. Mrs. Mortimer was presented with a bouquet. On the following day Mr. H. Pryce-Jones, Mid-Sussex manager, presented a golf bag to Mr. Mortimer on behalf of the district managers and senior officers of the Mid-Sussex Sub-Area.

W. T. Henley's Telegraph Works Co., Ltd., announce additional appointments to the board of the company as from 22nd July. **Mr. E. J. Vidler,** who has been general manager since January, 1954, now becomes director and general manager and **Mr. S. J. Beaney,** secretary of the company since April, 1954, becomes director and secretary.

Mr. Vidler joined Henley's as a junior in the Foreign Section of the Sales Department and has held the successive appointments of personal assistant to the sales manager, assistant sales manager, and sales manager. In 1950 he became assistant general manager, and in 1954 general manager. Mr. Vidler is also a director of Southern United Telephone Cables, Ltd., a director of United Telephone Cables, Ltd., and is Henley's accredited representative at all the conferences of the Cable Makers' Association.

Mr. E. J. Vidler

Mr. S. J. Beaney

Mr. Beaney also began his business career in Henley's sales organization which he joined in 1925. In 1950 he transferred to secretarial duties, being appointed personal assistant to the secretary. Three years later he became assistant secretary, and secretary of the company in 1954. Mr. Beaney is also secretary of Henley's (South Africa) Telegraph Works Co., Ltd., and a director of Commercial Secretaries, Ltd.

Mr. Robert S. J. Ansell has been appointed sales manager to the Broach Division of B.S.A. Tools, Ltd., at Redditch.

Mr. J. D. C. Churchill, at present Planning Officer of London Transport, has been appointed assistant secretary. He will continue to be responsible for the work previously the responsibility of the planning officer, except that traffic development work in connection with London Transport's railways will be carried out by the traffic development officer. The title of planning officer will be discontinued.

Mr. E. Lawrenson, M.A.(Oxon), has been appointed chief engineer of the Wireless Telephone Co., Ltd. (a member of the Plessey group). Before joining the Wireless Telephone Co. last year, Mr. Lawrenson was a senior engineer in the advanced development laboratory of Standard Telephones & Cables, Ltd.

Mr. E. Lawrenson

Mr. W. H. M. Jackson, O.B.E., industrial relations officer for the Cable Makers' Association for the past thirteen years, has retired and he has been succeeded by Mr. T. H. Pike. During this time Mr. Jackson was also secretary for the Employers' Associations on the Joint Industrial Council for the Electrical Cable Making Industry. He has maintained a lifelong interest in social welfare and continues to take an active part in many public welfare activities. He served as a member of the Gowers Committee appointed in 1946 to consider health, welfare and safety in non-industrial employment together with the hours of work of young people and shop hours. For many years he has been an active worker for the Y.M.C.A. and in 1944 he was appointed a director of the Central London Establishment.

Babcock & Wilcox, Ltd., announce the retirement of **Mr. J. Smith,** M.I.Mech.E., as managing director of Edwin Danks & Co. (Oldbury), Ltd. He has been appointed deputy chairman of the company as from 1st July.

Mr. J. Smith

Mr. Smith joined Edwin Danks as an apprentice in 1909. After being with other concerns from 1913 to 1920 he returned to Edwin Danks as technical sales representative, later becoming manager of the Erection and Repair Departments. He was appointed chief engineer in 1938 and managing director in 1943.

In addition to his membership of the Institution of Mechanical Engineers, Mr. Smith is also a member of the Institution of Heating and Ventilating Engineers and the Institutes of Fuel and Welding.

Mr. L. W. H. Rea, whose appointment as general manager of Edwin Danks has been previously announced, has been appointed managing director.

Mr. J. D. Craggs, Reader in Electronic Engineering at Liverpool University, has been appointed to the Robert Rankin Chair of Electronic Engineering in the University.

OBITUARY

Mr. Eason Scott-Purdie, of the Stage Lighting Department of the Strand Electric & Engineering Co., Ltd., died on 10th July at the age of forty-five. After spending upwards of ten years with the General Electric Co., Ltd., he served during the war with the 26th Battalion, London Electrical Royal Engineers (T.A.). He joined the Strand Electric & Engineering Co. in 1945.

Mr. T. E. Harris.—The death occurred on 18th July of Mr. T. Emlyn Harris, C.B., C.B.E., M.I.Mech.E., M.I.E.E., Deputy Director-General, Royal Ordnance Factories, Ministry of Supply. Mr. Harris was born at Aberbeeg, Mon, in 1894 and was educated at University College, Cardiff. From 1921 to 1924 he was with the Metropolitan-Vickers Electrical Co., Ltd., and he entered the Royal Ordnance Factories in the last mentioned year.

Mr. S. J. Pengilly.—The death occurred recently, at the age of forty-six, of Mr. S. J. Pengilly, district engineer, West Cornwall District, South Western Electricity Board. Before nationalization Mr. Pengilly had been for twenty years underground mains engineer with the Cornwall Electric Power Co. He was senior assistant engineer (construction), Cornwall Sub-Area, from 1948 to 1951.

Mr. E. E. Hoadley.—A memorial service for the late Mr. E. E. Hoadley, M.I.E.E., was held at the Queen's Chapel of the Savoy on 27th July, at which the chaplain, the Rev. C. Cresswell, officiated. Mrs. Hoadley and their son and two daughters were present and there were many representatives of the Institution of Electrical Engineers, the Electricity Boards and other electrical organizations. An address was given by Mr. J. Eccles, President of the Institution.

WILLS

Mr. A. J. Bonnella, director of D. H. Bonnella & Son, Ltd., who died on 25th September, 1954, left £36,831 gross (£35,954 net).

Mr. E. R. Elliston, A.M.I.E.E., late chairman and managing director of Elliston, Evans, and Jackson, Ltd., electrical and mechanical engineers, who died on 13th March last, left £50,306 gross (£48,104 net).

Mr. H. S. Carnegie, M.I.E.E., late deputy chief engineer, English Electric Co., Ltd., who died on 4th February last, left £13,488 gross (£13,301 net).

Mr. A. C. Dunnill, sales director of Hailwood and Ackroyd, Ltd., who died on 12th February last, left £6,838 gross (£4,705 net).

Mr. H. C. Booth, founder and former chairman of the British Vacuum Cleaner and Engineering Co., Ltd., who died on 14th January, left £80,936 gross (£79,875 net).

Mr. W. F. Furse, M.I.E.E., of Pelham Lodge, Ruddington, Notts, chairman of W. J. Furse & Co., Ltd., who died on 28th January last, left £77,077 gross (£76,710 net).

New Steel Rolling Mill

Samuel Fox & Co., Ltd., plan to install a highly mechanized combination bar and rod mill, together with special bar heat-treatment plant. The mill will roll bars and rods in alloy, high carbon and stainless steels from 0·212in to 2·5in diameter, the smaller-diameter products travelling through the rod mill at over 3,000 ft/min. Intended to replace an existing looping mill and a 14in double-duo mill at the company's Stocksbridge works, the new mill is being supplied by the Brightside Foundry & Engineering Co., Ltd.

Billets destined for rolling in the mill will first be charged into an oil-fired continuous pusher type furnace of 25 tons/hr capacity, but complementary batch furnaces will provide heating facilities for special qualities of steel, without interrupting production from the continuous furnace.

The first section of the mill will consist of a three-stand 18in mechanized roughing train, with two stands three-high and the third stand two-high, all driven by one 1,500 h.p. a.c. motor. This will be followed by a 14in single stand two-high mill driven by a 350 h.p. d.c. variable-speed motor. Four 11in two-high stands will be arranged in pairs to form the intermediate train, each stand being driven by a 350 h.p. d.c. motor. Next will come an 11 to 14in cross-country mill of four two-high stands, with individual 350 h.p. d.c. motors driving each stand. When rolling bars, the 14in stands will be used for the larger sizes and the 11in stands for the smaller sizes. All sizes of bar will be delivered in straight lengths to a cooling bed and two bar reels will be provided to coil all sizes up to 1in diameter or the equivalent. When rolling rod, the 11in stands will be used as an intermediate train, delivering the material to the continuous finishing train.

This continuous finishing train will consist of a six-stand alternate vertical and horizontal 10in mill to roll all sizes of rod. The train will be furnished with rod reels, the finished coils being delivered on to a system of cooling conveyors common to the bar reels. A 250 h.p. d.c. motor will drive each stand and the mill will roll at speeds in excess of 3,000 ft/min. The electrical equipment for the installation will be supplied by the Metropolitan-Vickers Electrical Co., Ltd.

The bar heat treatment installation will initially be capable of annealing and heat treating 14,700 tons of material per annum. The equipment will include two gas-fired furnaces of 10 tons capacity and four of four tons capacity, the latter being served by a floor type charging machine. One of the four-ton furnaces will be electrically heated. The new building, which will accommodate both the mill and the heat-treatment plant, will measure 950ft by 275ft.

Street Lighting Notes

Stage VI of the conversion of street lighting at DAGENHAM from gas to electricity will complete the change-over in the borough with the exception of 25 units in private streets and certain signs on county roads. It is estimated that the scheme, which will provide 3½ times the light given by the existing gas lighting, will cost £59,000.

SCUNTHORPE Corporation is recommended to seek sanction to borrow the sum of £14,536 in connection with schemes for the improvement of lighting in various streets.

SUNDERLAND Town Council is seeking loan sanction for £2,861 for converting street lighting from gas to electricity in Whitburn Road between Seaburn Terrace and the borough boundary.

APPLEBY Town Council has approved a scheme for installing electricity in the main streets of the town at £4,346.

BARROW-IN-FURNESS Corporation Highways Committee has received the consent of the Ministry of Housing and Local Government to the borrowing of £9,925 for street lighting.

REDCAR Town Council is recommended to carry out, next year, another stage in the scheme for converting street lighting from gas to electricity at a cost of about £20,000.

Prices of Materials

In the accompanying table we give the basis prices of the more important materials used in the electrical industry. The figures given are the selling prices and are those quoted on Tuesday last.

ALUMINIUM Ingots	ton £171 0s 0d
COPPER, H.C. Electro	ton £360 15s 0d
Fire Refined 99·70%	ton £359 0s 0d
Fire Refined 99·50%	ton £358 0s 0d
COPPER Tubes ..	lb 3s 5½d
Sheet	ton £429 5s 0d
H.C. wire and strip ..	ton £406 5s 0d
LEAD, English ..	ton £107 15s 0d
Foreign	ton £106 0s 0d
MERCURY	flask £108 0s 0d
TIN, block (English) ..	ton £761 0s 0d
ZINC, G.O.B. Foreign	ton £89 5s 0d
Electrolytic	ton —
BRASS Tubes (solid drawn)	lb 2s 9d
Sheet	ton £335 15s 0d
Wire	lb 3s 4½d
PHOSPHOR BRONZE Wire	lb 5s 0½d
PLATINUM	oz £29 0s 0d
RUBBER, No. 1 R.S.S. spot	lb 40½d—41½d

INDUSTRIAL NEWS

Census of Production

The *Board of Trade Journal* of 30th July publishes some provisional results of the 1953 Census of Production calculated from a sample inquiry covering about one-sixth of the establishments, of which about 90 per cent had replied up to the end of 1954. On this basis the net output of the electrical engineering industry (general) in 1953 is given as £214·3 million (against £185·4 million in 1951); the number employed is put at 292,600 (295,500); total stocks and work in progress at the beginning of the year at £151·3 million (£97·1 million); and capital expenditure during the year at £12·6 million (£11·0 million).

The net output of the electric wire and cable industry in 1953 is calculated at £40·4 million (£36·3 million); employment at 50,100 (50,000); stocks at beginning of year £38·3 million (£27·3 million); and capital expenditure at £3·5 million (£2·6 million). For the radio and telecommunications industry net output is given as £150·2 million (£127·1 million); employment as 257,700 (237,300); stocks at beginning of year as £89·2 million (£52·6 million); and capital expenditure as £7·0 million (£6·6 million).

Value of net output of the electricity supply industry in 1953 is put at £234·8 million (£185·7 million), including meter and appliance rentals, net receipts from the sales of appliances and "new constructional work carried out by employees of the undertakings." The number employed is given as 189,200 (185,100) and capital expenditure (including meters, mains, services and new issues of appliances for hire) as £181·5 million (£150·6 million).

Great Yorkshire Show

At the recent Great Yorkshire Show the Yorkshire and North Eastern Electricity Boards combined to present a comprehensive display of machines and appliances for every branch of farming. In the horticultural section, two glasshouses were erected where the technique of seedling irradiation and soil warming was demonstrated. Machines for compost shredding, soil screening and pot washing and equipment for soil sterilizing were exhibited, also a sectional boiler equipped with automatic stoker and forced draught under thermostatic control and pumps for forced circulation of hot water. The dairy section showed steam generators of various sizes operating on time switch control, storage water heaters and milk coolers of both the ice bank and direct expansion type, also two makes of deep freeze cabinets.

In the central covered space hammer mills and food mixing machines of various makes and sizes were demonstrated. Machinery for the various methods of grain drying, in-silo, in-sack or in-tray, together with conveying and lifting machinery, were also shown. A half-scale barn hay drying floor was constructed with examples of fans used for this process of hay making and samples of hay from plants working in the West Riding were on view. On the domestic stand cookery demonstrations were given at frequent intervals and cookers, water heaters, washing machines and refrigerators were displayed.

Mining Qualifications Rules

The Minister of Fuel and Power has approved the "Mining Qualifications (Mechanics and Electricians) Rules, 1955," which came into effect on 1st August, 1955. The Rules prescribe the qualifications to be held by applicants for the new certificates (apart from service certificates) required of mechanical and electrical engineering staff at mines by the Coal Mines (Mechanics and Electricians) General Regulations, 1954. The following certificates are provided for:—Mechanical engineers; electrical engineers; mechanics, Class I; electricians, Class I; mechanics, Class II; and electricians, Class II. The Rules are accompanied by explanatory notes and syllabuses. Copies of the Rules, price 1s net, may be obtained from H.M. Stationery Office or any bookseller.

Electrical Apprenticeship Awards

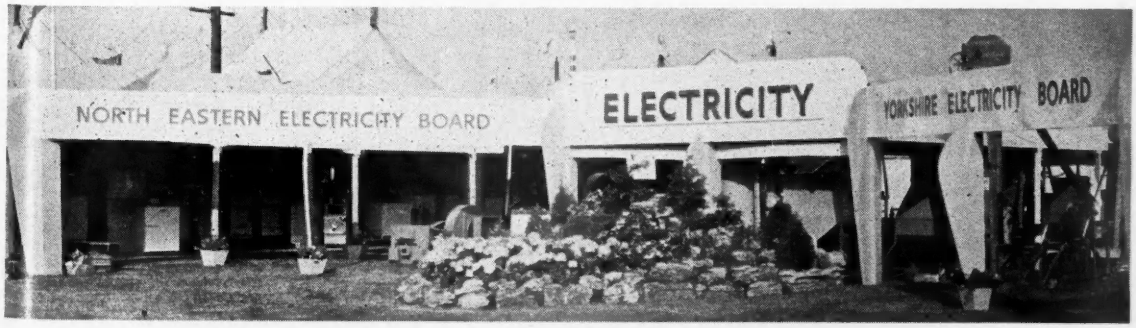
The Apprenticeship and Training Council for the Electrical Contracting Industry has awarded a scholarship for 1955 to Derek Howe, of Oldham, Lancs, an electrical apprentice with the Co-operative Society, Manchester, and a student at Oldham Municipal Technical College, who is an apprentice registered with the Council. The scholarship, which is worth about £750, is tenable for a three-year degree course at a university or for a higher national diploma course at a technical college.

Grants in respect of outstanding merit have also been made to two other electrical apprentices, Edward Arthur Ingle, of Whetstone, Middlesex, and Michael Herbert Hamman, of Kenton, Middlesex, both of whom are with Marryat & Place, Ltd., and are pursuing the higher national diploma course at the Borough Polytechnic, London.

Television in Uruguay

The Commercial Department of the British Embassy in Montevideo recently reported that a contract had been placed by the Servicio Oficial de Difusion Radio-electrica (S.O.D.R.E.) for the installation of a television transmitter and equipment with the General Electric S.A. of Uruguay. It was further stated that the General Electric S.A. is already preparing for the complete manufacture of television receivers, including the cathode ray tubes. In a general conclusion to the report the Commercial Department expressed the opinion that there is no reason why British television receivers should not be sold on this market, and British manufacturers interested should study without delay an arrangement for at least local assembly with a suitable Uruguayan firm. This

The combined stand of the Yorkshire and North Eastern Electricity Boards at the recent Great Yorkshire Show



general statement has now been reinforced by additional information recently received to the effect that S.O.D.R.E. is contemplating calling for tenders for the supply of 10,000 television receivers in order to initiate the opening of the future television transmission. In the event of any interested United Kingdom manufacturer not being already represented in Uruguay, the Embassy is acquainted with a local agent of good standing who has expressed a desire to obtain the representation of a United Kingdom T.V. receiver manufacturer. The Export Services Branch of the Board of Trade, Lacon House, Theobalds Road, London, W.C.1, is willing to communicate with the Embassy on behalf of any interested maker. Reference E.S.B./12588/54 in any correspondence should be quoted.

B.B.C. in 1954-55

Reference is made to the inevitability of increased costs as a result of the institution of commercial television in the report of the British Broadcasting Corporation for the year ended 31st March last (H.M. Stationery Office, 4s 6d). The Corporation says that it cannot fulfil its television obligations with a single programme but the Government has not yet decided to allot it the necessary channels for a second programme. Nevertheless, to avoid any undue delay preliminary technical preparations have been made.

During the year the number of television licences in force rose from 3,248,892 to 4,503,766 and there were well over nine million radio licences in force. Extensive tests of colour television are to be made later this year in an endeavour to ensure that any system introduced will be satisfactory both in colour and black and white.

Six medium power television transmitting stations working on a temporary basis are expected to be completed this year or early in 1956. The new Crystal Palace high power transmitter, which is to take the place of that at Alexandra Palace, is expected to be ready early next year.

Ten v.h.f. sound broadcasting stations, covering about 80 per cent of the population, will be commissioned by the end of 1956; one, at Wrotham, is already in service and four others, and a temporary transmitter in Anglesey, will be operating before the end of this year. This "revolutionary development," says the report, is a challenge not only to the B.B.C. but to the radio industry.

Revenue expenditure on sound radio in 1944-45 amounted to £10,018,779 and that on television to £5,043,908. With the addition of tax adjustments and payments the total expenditure was £17,780,112. There was a balance of £3,024,875 to which was added the balance brought forward, making £4,351,159. From this capital account receives £2,967,725 and the remainder is carried forward.

New E.A.W. Address

All communications to the Electrical Association for Women and to Dame Caroline Haslett should now be addressed to 25, Foubert's Place, W.1 (telephone: Gerrard 5212).

Generation in Great Britain

Our attention has been drawn to some errors which appeared in the article and schedules under the above heading in the *Electrical Review* of 24th June. On page 1122 references are made to the "C.E.A." Actually the Authority at the relevant time was the "B.E.A."

As we explained, the references to the C.E.A. covered the S.E. and S.W. Scotland Divisions which were detached from the B.E.A. on 1st April last.

The total installed capacity of generating plant of B.E.A. stations should be amended to 19·97 million kW. Under the heading of "Thermal Efficiencies," the figures quoted for 1954 and 1952 refer, of course, to steam stations. In the third paragraph under this heading, "Stourport 'B'" should read "Stourport 'B' L.P." and "Dunston 'B'" should read "Dunston 'B' II." In the schedule of power stations as at 31st December, 1954, an error occurs on page 1125 where the figures given for Stourport "B" H.P. and L.P. sections have been reversed in the last six columns. Thus the "Year of commissioning of latest existing sets" should be 1950 for the L.P. section and 1954 for the H.P. section and so on.

N.A.L.G.O. Jubilee

The National and Local Government Officers' Association was formed as the National Association of Local Government Officers on 29th July, 1905, and thus reached its golden jubilee last week. The change of name was necessitated largely by the nationalization of many services, taking them out of the hands of local authorities; the Association's membership of 230,000 includes a large number in the electricity supply industry.

It is the boast of N.A.L.G.O. that it has never had a strike or been disrupted by internal strife or breakaway movements. It has continuously improved the pay and conditions of its members but the jubilee president, Mr. P. H. Harrold, C.B.E. (Town Clerk of Hampstead) told a Press conference last week that even now they were worse off than before the war and the efficiency of the public services was imperilled because they were failing to attract the right kind of workers.

Mullard's Offer to Cambridge

It is reported that Mullard, Ltd., has made an offer of £100,000, in ten annual instalments, to Cambridge University for the establishment of a radio-astronomy laboratory in connection with the Cavendish Laboratory.

Telecommunications Equipment for Canada

About a year ago the Canadian Marconi Co. placed a large order for communications transmitters and receivers with Marconi's Wireless Telegraph Co., Ltd., Chelmsford. This contract, originating from the

Members of the London and Kent Branches of the Association of Mining Electrical and Mechanical Engineers during their recent visit to the B.T.H. Rugby Works

Canadian Overseas Telecommunications Corporation, provided the main materials for new long-distance transmitting and receiving stations to be built at Vancouver and for the expansion of the Montreal station. Another substantial order has now been received by Marconi's from the same source. This calls for more equipment for the same projects. The new contract provides for the supply of six Marconi-Siemens radio-telephone terminal equipments, type HW21, together with inverters, channel displacing and restoring equipment and several channel bays of five-band privacy equipment.

Laxton's Builders' Price Book

The 1955 edition of Laxton's Builders' Price Book, edited by P. T. Walters, F.R.I.C.S., is now available from Kelly's Directories, Ltd., 186, Strand, London, W.C.2 (price 35s).

The whole of the prices in this 128th edition have been revised and incorporate the increased wages which became operative in April last. The current wage rates and gradings for most towns are given with relevant extracts from the London Working Rules Agreement and the latest national schedule of daywork charges, professional scales of fees and charges; and other useful data and memoranda are included as usual.

An important part of the book is the list of brands and trade names, containing approximately 11,000 items, together with a separate alphabetical list of firms' names and addresses.

Line Erector Contract

An order for 12 Lennox Lomax line erectors has just been completed and shipped to the Burmese Government. These erectors are built by the Lennox Motor Co., Ltd., and are based on the "Fordson Major" diesel tractor.

Change of Address

The Independent Television Authority, which since October, 1954, has been in temporary offices at Wood's Mews, Park Lane, W.1, has now moved to its permanent headquarters at 14, Princes Gate, S.W.7 (telephone: Knightsbridge 5341).

Educational

Enrolment begins on 19th September for the 1955-56 session in the Department of Applied Chemistry at the Northampton Polytechnic, St. John Street, London, E.C.1.

British Driver-Harris Conference

Early in July a technical conference was held at the Cheadle works of the British Driver-Harris Co., Ltd., Manchester. The conference was attended by technical representatives from the associated companies in France, Italy, Austria and Spain. Developments in the field of electrical resistance materials were reviewed and the visitors had an opportunity of seeing the extensions to the works, part of a very heavy building programme, and also of inspecting the recent additions of specialized plant and processing equipment.

Annual Holidays

The works of Hirst Electronic Development, Ltd., Crawley, are closed from to-day (Friday) until 22nd August.

Trade Announcements

Cantie Switches, Ltd., has established new branch offices as follows:—248, West George Street, Glasgow, C.2 (telephone: Central 3739), under the management of Mr. T. C. Paton, Scottish area manager; 32, Deansgate, Manchester, 3 (telephone: Blackfriars 3851) (Mr. J. T. Jolley, manager for the North Western area); Room No. 31, Sun Insurance Buildings, Collingwood Street, Newcastle-on-Tyne, 1 (telephone: Newcastle 29171) (Mr. W. K. Freeman, North Eastern area sales engineer); and 37, Talbot Street, Nottingham (Mr. A. E. Royle, East Midlands area sales engineer). Another branch office will shortly be established at Leeds, under the management of Mr. N. Rayner.

New offices and showroom have been opened by **Hoover, Ltd.,** at 91-95, Commercial Road, Portsmouth (telephone: Portsmouth 70972/3). The workshop and storeroom for the district is, as hitherto, at 67, Elm Grove, Portsmouth.

Dewhurst & Partner, Ltd., have opened a branch office at 56-58, Barton Street, Gloucester (telephone: Gloucester 25613). From this office their business activities for the South Wales and Western areas will be conducted by Mr. R. F. Burrows, who has been appointed branch manager.

CATALOGUES & LISTS

CABLES.—72-page catalogue containing illustrations and details of all types of p.i. cables, lead or aluminium sheathed (C); 32-page catalogue covering a wide range of rubber-insulated cables (R); and an illustrated booklet dealing with 33 kV solid type cables (508).—**W. T. Henley's Telegraph Works Co., Ltd.,** 51/53, Hatton Garden, London, E.C.1.

Three publications dealing with lead sheathed p.i. cables from 1,100 V to 33 kV (EN.102); "Enfield" grid suspension wiring harness (EN.208); and joint box compounds (EN.107b).—**Enfield Cables, Ltd.,** Victoria House, Southampton Row, London, W.C.1.

COLLOIDAL GRAPHITE. — Technical folder setting out a list of "dag" dispersions of colloidal graphite and other solids.—**Acheson Colloids, Ltd.,** 18, Pall Mall, London, S.W.1.

COMMERCIAL LIGHTING.—40-page catalogue in colour describing the company's latest range of commercial lighting fittings.—**Holophane, Ltd.,** Elverton Street, London, S.W.1.

COOKERS.—Illustrated leaflet giving information on the Moffat "Handi-Broil" control now incorporated in models 3165 and 3144A.—**Moffats, Ltd.,** 1, Newman Street, London, W.1.

DIGITAL COMPUTER. — Illustrated technical booklet on the "Deuce" digital computer.—**English Electric Co., Ltd.,** Industrial Electronic Division, Kidsgrove, Stoke-on-Trent.

INSTRUMENTS.—Leaflet covering the "Pullin" Series 100 multi-range test set.—**Measuring Instruments (Pullin), Ltd.,** Electrin Works, Winchester Street, Acton, London, W.3.

Technical leaflet on the "Commander" KP pressure recorder for the measurement of pressure of water, steam, oil, air, gas or other fluids.—**George Kent, Ltd.,** Luton, Beds.

Leaflets describing new additions to the company's range of "Nullmatic" instruments.—**Sunvic Controls, Ltd.,** 10, Essex Street, Strand, London, W.C.2.

LIGHTING FITTINGS.—26-page illustrated, priced catalogue of table lamps, bed lights, fittings, etc., including "Nylux" shades.—**Knightshades, Ltd.,** Derby Road Works, Montagu Road, Edmonton, London, N.18.

PLASTICS.—28-page illustrated booklet on "Fibreglass" reinforced plastics dealing with the various techniques available to moulders and industrial organizations.—**Fibreglass, Ltd.,** Ravenhead, St. Helen's, Lancs.

TRADE MARK APPLICATIONS

APPLICATIONS have been made for the registration of the following trade marks. Objections may be entered up to dates mentioned:—

13th August

FRACTICHRON. No. 740,460, Class 9. Electronically operated time measuring apparatus and parts.—Dimafon, Ltd., 10, St. Swithin's Lane, London, E.C.4.

CUT-THE-CACKLE. No. 741,139, Class 9. Electric switches.—Emile Littler, 31, St. Martin's Lane, London, W.1.

20th August

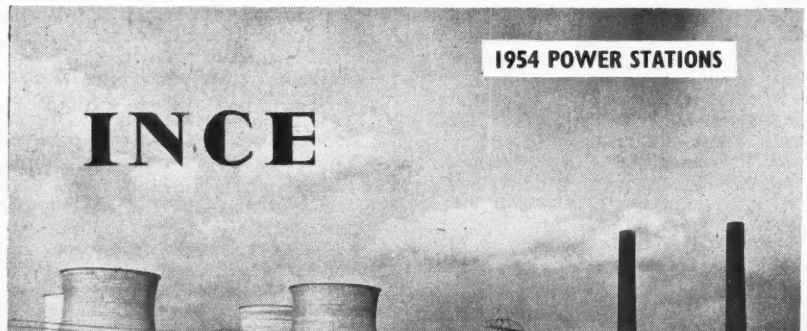
PEVIC. No. 739,221, Class 9. Electrical apparatus and instruments; and scientific apparatus and instruments.—Wireless Telephone Co., Ltd., Hallamgate Works, Crookes Road, Sheffield, 10.

No. 739,148 (design), Class 9. Electrical apparatus and instruments; scientific, weighing and measuring apparatus and instruments; and tape for use as recording media in sound recording apparatus.—Badische Anilin & Soda-Fabrik Akt.-Ges., Ludwigshafen-on-Rhine, Germany. Address for service, c/o J. Y. & G. W. Johnson, 47, Lincoln's Inn Fields, London, W.C.2.

SONOSCRIBE. No. 739,453, Class 9. Electrical and magnetic sound recording and sound reproducing apparatus.—Soundscriber Corporation, New Haven, Conn., U.S.A. Address for service, c/o Stevens, Langner, Parry & Rollinson, 5-9, Quality Court, Chancery Lane, London, W.C.2.

PALEC. No. 739,562. PALEC (design). No. 739,563, Class 9. Electric switches.—Paton Electrical Proprietary, Ltd., Ashfield, Sydney, N.S.W., Australia. Address for service, c/o A. A. Thornton & Co., Napier House, 24-27, High Holborn, London, W.C.1.

EVER READY (design). No. 737,418, Class 11. Flash lamps and electric torches; and electric lamps and bulbs therefor.—Ever Ready Co. (Great Britain), Ltd., Hercules Place, Holloway, London, N.7.

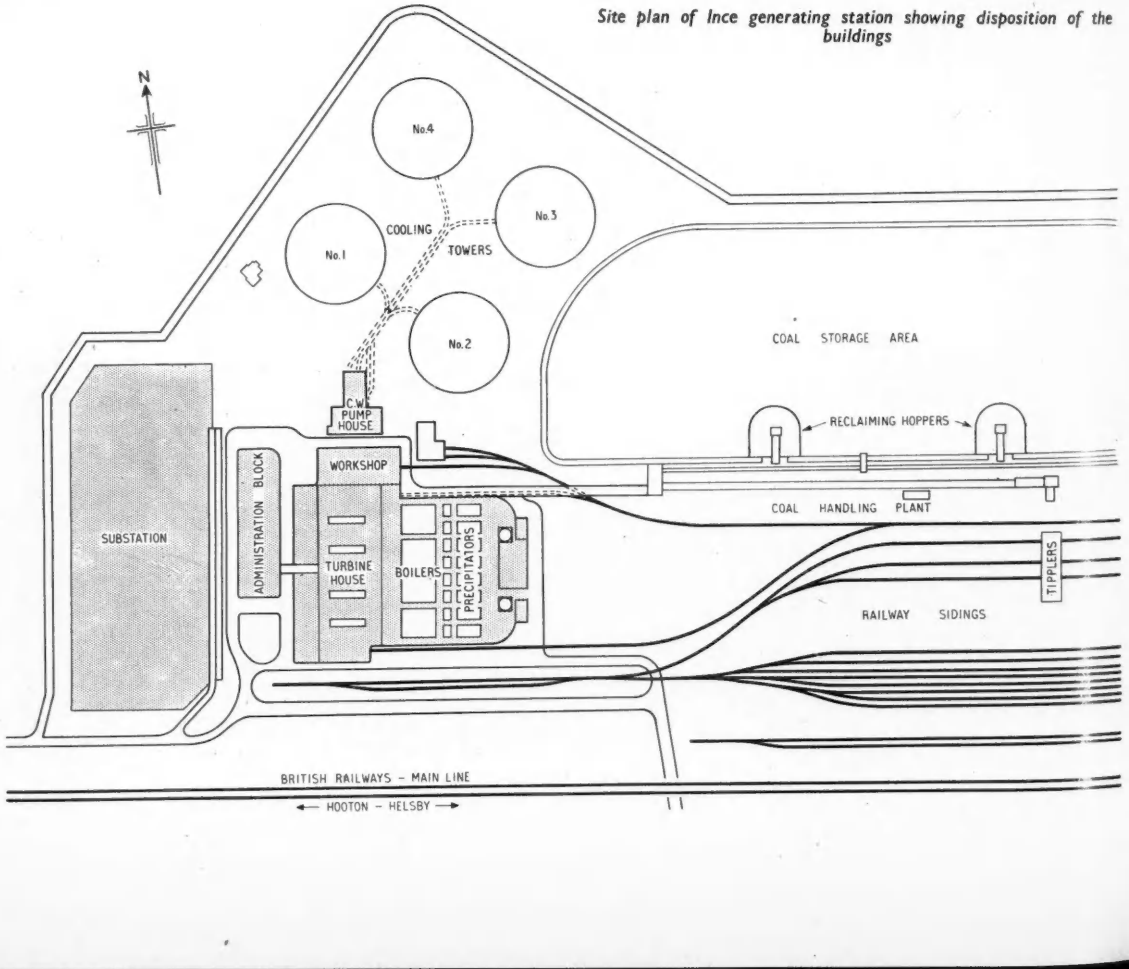


CONSTRUCTION PROGRESS ON A 240 MW SEMI-OUTDOOR STATION

CONSTRUCTION work on the 240 MW semi-outdoor base load generating station at Ince, near Chester, is now at an advanced stage and two of the ultimate four 60 MW hydrogen-cooled sets are already in commission. It is planned to commission the third set towards the end of this year and the fourth one during 1956.

As is usual these days the station is of unit design, there being one boiler for each of the 60 MW turbo-alternator sets. It is built on a marshy site about eight miles to the north of Chester and four miles from Ellesmere Port. The choice of site was restricted by the necessity for providing a large generating station within reasonable reach of an anticipated heavy load even though adequate cooling water supplies were not close at hand. The station buildings proper are built upon an outcrop of sandstone but the cooling towers and coal handling plant are constructed on marshy ground and considerable piling has been necessary. The Birkenhead to Runcorn main railway

Site plan of Ince generating station showing disposition of the buildings



line passes along one boundary of the site and a single track entry is provided to the coal sidings. Good road access for coal supplies is also available if necessary. The coal storage area has a capacity of about 100,000 tons.

The turbine house is of conventional red brick construction about 350ft long and 100ft wide, the width having been reduced by the provision of rotor withdrawal doors. The most unusual feature of the design occurs in the boiler house which is semi-outdoor, all cladding being of "Cellactite" sheeting. The primary superheater compartment, economizer and air heaters are out of doors, as also are the grit arrestors, fans and precipitators. The site of the 132 kV substation was chosen in order that the prevailing wind should carry the cooling tower plumes away from it.

There are two brick chimneys, each 300ft high, arranged one for each pair of boiler units. The four reinforced concrete cooling towers, each of 2·75 million gal/hr capacity, are 250ft high and 205ft pond diameter and are to the north of the main building. Supplies of cooling water are brought by special pipeline from the pumping station at the River Dee eight miles away.

The administration block, canteens and amenity building are combined and are connected to the west side of the turbine room by means of a bridge. The amenity building includes air-conditioned locker and shower facilities. The central heating of this group of buildings, and also domestic hot water, is provided by bled steam from one of the turbines, the third bled steam stage being used. A 150 kW electrode boiler is used as stand-by. Also in the office block and adjacent to the bridge are the control room, relay and metering room, and the charge engineer's office.

The completed station will accommodate four 550,000 lb/hr pulverized fuel boilers manufactured by International Combustion, Ltd., the steam conditions at the boiler stop valve being 950 lb/sq in and 925 deg F. Superheat control is effected by means of tilting burners which are automatically operated by equipment supplied by George Kent, Ltd., and also by primary superheater by-pass dampers manually operated from the boiler unit control panel.

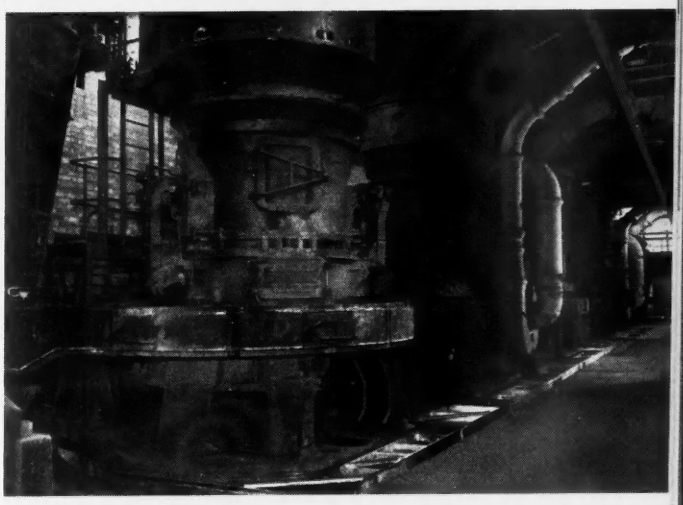
The milling equipment for each boiler consists of four "Lopulco" type L.M.14 mills each of 13 tons/hr capacity, each supplying one burner in each corner of the combustion chamber. In addition a small "Impax" hammer mill is provided for lighting-up purposes. Its capacity is 2 tons/hr and it is possible to raise pressure by means of continuous firing. The mill supplies two coal burners in the front wall of the combustion chamber.

The motors driving the mill exhausters, coal feeders and separators are of the Laurence Scott variable-speed type, speed being controlled by induction regulators. Each boiler has two 485 h.p. induced draught fans and two 320 h.p. forced draught fans, driven by two-speed a.c. motors, the draught being controlled by the vanes. The mill exhausters are of a new type having two stages in series in an effort to improve exhauster performance.

The station has been designed to burn East Midlands coal having a calorific value of 10,000 to 11,000 B.Th.U/lb. The combustion chamber is of the radiant type and is completely water cooled. The secondary pendant type of superheater is arranged in the exit pass and is shielded from direct radiation. The gases then pass through the primary superheater to the all-welded Senior steaming economizer.

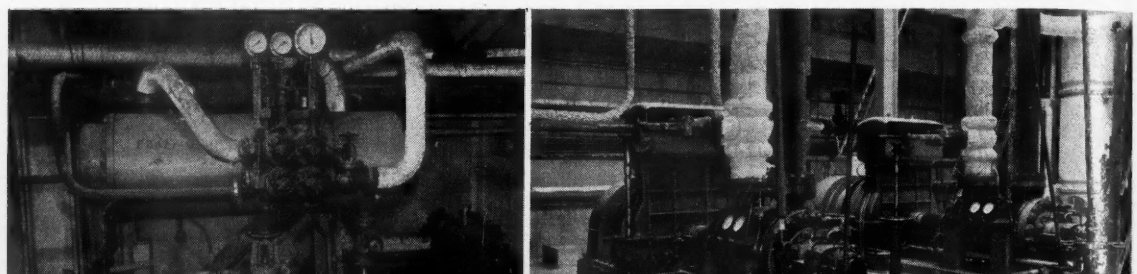
The bunker capacity for each boiler is 900 tons, coal being supplied to each mill by a rotating feeder table. The rate of coal feed is normally varied via Electroflo automatic combustion control equipment by varying the speed of the feeder motor, but additional manual controls are the position of the "plough" which removes the coal

A view of No. 1 boiler from drum level



Four 13 tons/hr capacity p.f. mills feed each boiler

Each of the four 550,000 lb/hr boilers is of semi-outdoor construction



Left: Two oil firing units serve all four boilers for lighting-up purposes. Right: Two 100 per cent duty feed pumps are provided for each unit

from the feeder table and also a vertical sleeve which controls the cone formation of coal carried by the table.

For lighting the main coal burners and also for maintaining ignition under unstable conditions, two Wallsend Slipway oil burners are fitted in each corner burner box and a further two are provided for the "Impax" mill. The consumption of each burner is about 300 lb/hr.

The Babcock & Wilcox boiler ash hopper is water filled, which greatly simplifies ash removal. During ashing, the hopper is drained and high-pressure water nozzles remove the ash from the hopper and convey it by a sluiceway to settling pits. The refractory ash hopper walls are cooled by water sprays. Two air heaters are provided for each boiler and are of the rotary Ljungstrom type made by Howdens. Grit collection is by Howden "Centicell" mechanical grit arrestors, followed by Sturtevant electrostatic precipitators.

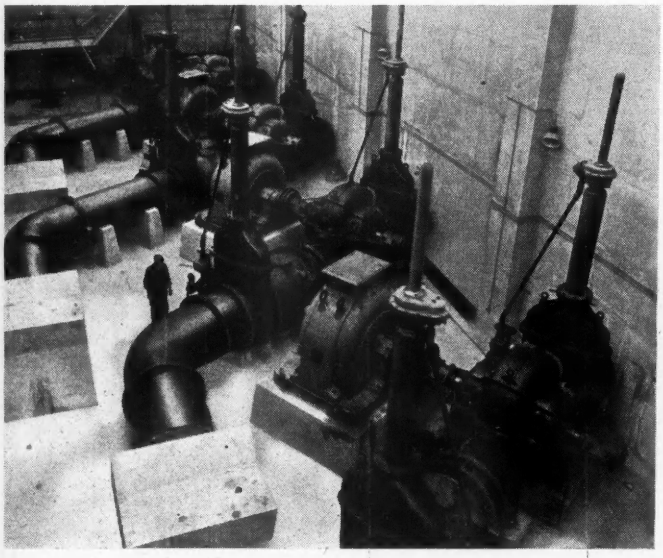
In the station design the cladding of the boiler house has been restricted to the minimum and this has raised some difficulties in routing drain pipes, remote water level gauge pipes, etc. Where possible the pipes have been arranged close to the boiler casing and vertical routes are within the enclosed space between the boiler and the turbine house. Enclosure at drum level has been arranged in order to provide maximum comfort for operating personnel during overhaul by separating the boilers.

The Electroflo automatic boiler control relates total air flow, as measured by a venturi approach to the f.d. fan intakes, to total steam flow. The i.d. fans are controlled by a furnace pressure relay which is capable of variation from the unit control panel to provide the desired combustion chamber suction. Further venturis are fitted in each mill group in order to obtain the correct ratio of primary air to fuel. Each mill group has an anti-choking device the effect of which is to increase the exhauster speed to maximum and the coal feeder speed to minimum; this device is actuated by the mill differential draught. As usual, master control is from boiler pressure.

Feed water control utilizes Cope's thermostats and "Flowmatic" regulators. Chemical dosing is added to the rear boiler drum via a high-pressure vessel which uses the pressure drop through the economizer for injection.

The soot blowers, supplied by the Ivor Power Specialty Co., Ltd., consist of 12 combustion chamber wall blowers, six lance blowers for the secondary and primary superheaters and eight air heater blowers. These are all remotely operated from the unit control panel.

The four 2·65 million gal/hr circulating water pumps are in a separate pumphouse between the cooling towers and turbine room



The Turbo-Alternators

The 3,000 r.p.m. turbo-alternators are of Fraser & Chalmers-G.E.C. manufacture, each unit having a maximum continuous rating of 60 MW. The design terminal steam conditions are 900 lb/sq in and 900 deg F at the turbine stop valve, with 28·7in vacuum and a final feed temperature of 385 deg F. The guaranteed heat consumption is 9,251 B.Th.U/kWh generated at m.c.r.

The turbines are two-cylinder units, arranged transversely. The h.p. cylinder is reversed, as is customary with G.E.C. turbines, in order to minimize thrust problems, and the h.p., l.p. and alternator shafts are solidly coupled, so that only one thrust bearing is required. The turbines are of the impulse type with twenty h.p. stages and six stages in each of the l.p. cylinders.

Two emergency stop valves supply four throttle valves symmetrically disposed around the inlet belt and the emergency valves lead the throttle valves by a small amount so that throttling takes place in two stages. The main oil pump is of the centrifugal type and a considerable volume of oil is circulated by a booster injector to maintain

a positive head on the suction side of the pump. All other oil pumps are electrically operated and consist of an auxiliary oil pump, an emergency oil pump supplied from the 240 V station batteries and capable of running for about 40 min in the event of total failure of supplies, a flushing pump, a jacking pump, and a separate hydrogen seal oil pump for use when the main bearing oil system is out of commission. All of the oil pumps, except the emergency pump, are driven by a.c. motors.

Each 60 MW 11·8 kV hydrogen cooled alternator operates at a hydrogen pressure of 0·5 lb/sq in and the gas is cooled by circulating water by means of four heat exchangers disposed one at each corner of the alternator. This arrangement provides ready access for cleaning and maintenance.

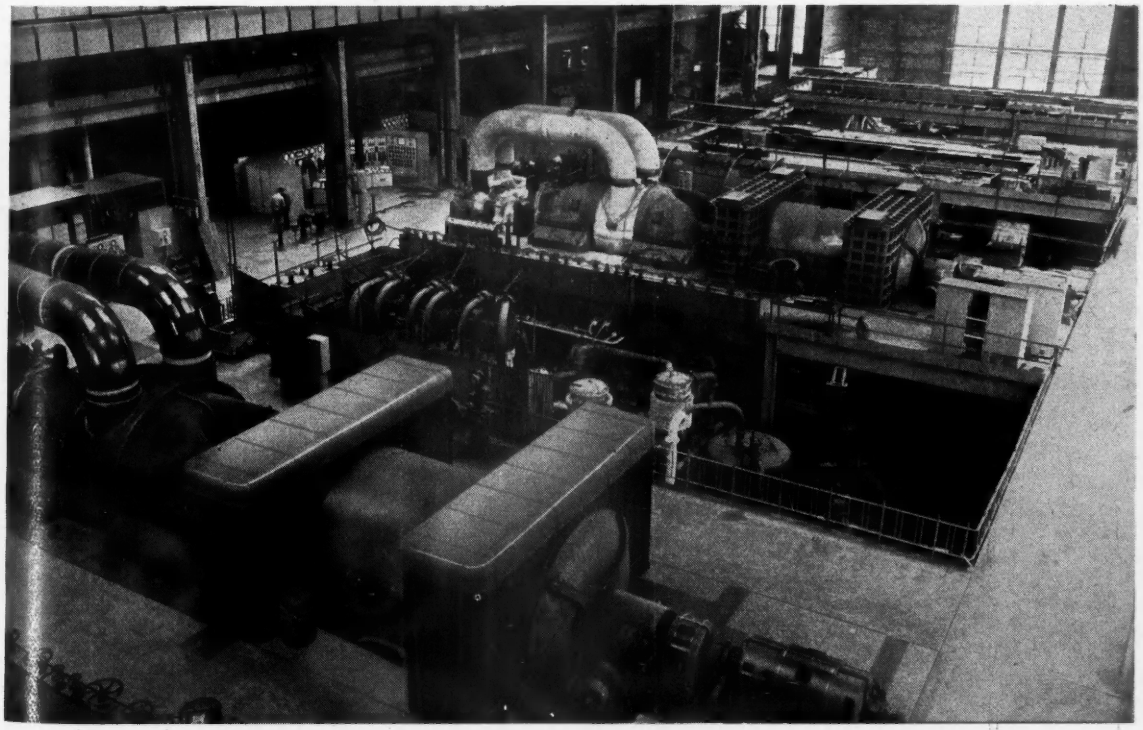
Each of the generators is directly connected to a 11·8/132 kV, 72 MVA generator transformer switched on the 132 kV side by means of an English Electric air-blast circuit-breaker. Supplied direct from the alternator busbars is an 11·8/3·3 kV, 5 MVA unit transformer switched at 3·3 kV by an English Electric air-break circuit-breaker. The exciter is directly driven at 3,000 r.p.m. and is coupled to the alternator shaft by a quill type flexible coupling. Mounted on the end of the exciter is an electrical tachometer which enables the speed of the machine to be recorded and is of great assistance during running up. In addition it supplies a relay capable of tripping the machine on overspeed as back-up to the normal mechanical devices. Supervisory gear is provided which records vertical and horizontal eccentricity of the shaft at the governor end, axial displacement and speed; it also indicates throttle and emergency valve positions. Vacuum unloading, commencing at 26in Hg, vacuum trip operating at 20in Hg, boiler pressure unloading capable of variable setting, low oil level trip and thrust wear trip are among the automatic protective devices fitted.

The condensing and feed heating plant is being supplied by Hick, Hargreaves & Co., Ltd. The condensers are of twin shell three-pass type and the total cooling surface is 58,000 sq ft, the design circulating water inlet temperature being 65 deg F to give a condensate temperature of 87 deg F at full load flow of 41,500 gal/min.

The feed heating train consists of two low-pressure and three high-pressure feed heaters, the second low-pressure heater being of the direct contact type and thus providing a measure of series de-aeration. Provision of a direct contact heater necessitates the use of additional heater extraction pumps which deliver the condensate at 214 deg F to the suction of the feed pumps. There are two 100 per cent duty feed pumps. On sets 1 and 2 pumps of Swiss (Sulzer) manufacture are provided, each having Brown-Boveri 3·3 kV, 1,500 h.p., 2,960 r.p.m. motors. On sets 3 and 4 the Hathorn Davey pumps have English Electric 3·3 kV, 1,400 h.p., 2,970 r.p.m. motors. Pressure relays are fitted to start the stand-by pump automatically in the event of a pump failure. A storage vessel and shunt de-aerator are provided in the surge tank connection, the de-aerator capacity being 80,000 lb/hr with a guaranteed maximum oxygen content of 0·01 c.c./litre. The combined effect of the shunt de-aerator and direct contact heater has been to greatly simplify the problems of oxygen control.

Four circulating water pumps, each of 2·65 million gal/hr capacity, are installed in a separate pumphouse situated between the cooling towers and the turbine room. The circulating water system splits naturally into two parts each comprising two cooling towers and two circulating water pumps supplying one condenser on each set. Cross-over connections are provided between pump delivery and condenser discharge culverts. The culverts connecting the towers, pumphouse and turbine room are of reinforced concrete construction. In addition, water from the

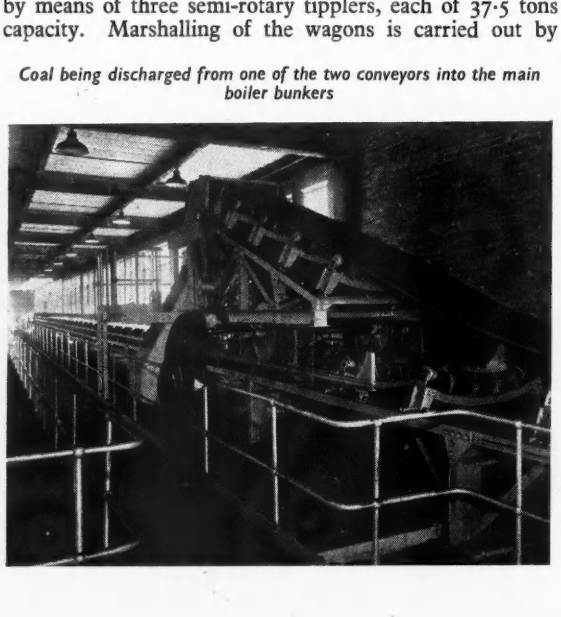
General view of the turbine room showing Nos. 1 and 2 sets



circulating water system is used for sealing of the h.p. ash pumps, boiler make-up, dilution of acid effluent from the softening plant and fire services. The four cooling towers each of 2·75 million gal/hr capacity, were supplied by Film Cooling Towers, Ltd. The pond of each tower holds about 1 million gal of water, the tower height is 250ft and the diameter of the pond at floor level is 205ft. The softening plant was supplied by the Permutit Co., Ltd., and is of the clarification and HI/Na blend type. The raw water is dosed with alum and pumped through 8ft diameter sand filters to a tank on the roof of the plant. From there it passes to the two base exchange and the two hydrogen ion exchange units and the effluents are blended to give water of the required composition. After being degassed to remove CO_2 the water is ready for evaporation. Control of the plant, including blending and the regeneration of the units, is fully automatic except for the filters which require to be backwashed by hand control at intervals. The normal water supply will be from the River Dee but by means of an isolating distance piece Mouldsworth water can be quickly made available if necessary. The clarification capacity is 15,000 gal/hr and the blending capacity is 14,200 gal/hr. Each turbo-alternator is fitted with a Paterson condensate treatment plant. This consists essentially of a variable stroke pump driven by a variable speed motor controlled electronically by a flow meter in the condensate return line. The pump draws from a chemical storage tank which holds sufficient solution for 24 hours' running at maximum speed, and discharges into the condensate return line. As a result of the pump being controlled by the flow meter the dosage of the condensate will be constant in spite of any variation in load, since at all times the ratio of treatment to condensate is constant. With the pump set at $\frac{7}{10}$ of full stroke it will deliver $5\frac{1}{4}$ gal/hr at full speed and the chemical tank of 130 gal will treat 12,216,000 lb of condensate. The chlorination plant was supplied by Wallace & Tiernan, Ltd., and is fully automatic, injection taking place in sequence to each condenser. The plant has a maximum chlorine consumption of 2,000 lb/day and with a flow of $1\frac{1}{4}$ million gal/hr of cooling water to each condenser a maximum dosage of 7·5 ppm can be obtained. The drum house has storage for eight drums of chlorine which will provide a minimum supply of 12 days at the highest possible rate of dosage.

The coal is delivered to the station by rail, and is tipped by means of three semi-rotary tipplers, each of 37·5 tons capacity. Marshalling of the wagons is carried out by diesel locomotives, and handling to the tipplers is by electrically operated "beetles." The beetle travels along its own track within the railway lines and extends roller arms to engage with the wagon wheels hauling it on to the tippler. Outhaul beetles are also provided for moving wagons away from the tippler. Duplicate belt conveyors take the coal to bunker level, the capacity of each being 200 tons/hr. From a point on the route to the bunkers further conveyors lead to one side of the coal stocking ground where a traversing wing conveyor throws the coal to a distance of about 12ft from the conveyor structure whence it is bulldozed as required. For stocking out and reclaiming, there are three Fowler bulldozers with hydraulically operated blades. Coal is reclaimed via pits into which it is pushed by bulldozers and fed by vibrators on to belts which in turn feed the main conveyors to bunkers. The conveyor system is remotely controlled from the tippler house, the control panel being fitted with a striplight diagram of the system. The conveyors are sequence interlocked to minimize the effects of chute blockages or conveyor failures.

Coal being discharged from one of the two conveyors into the main boiler bunkers



Mr. A. Parker, superintendent of Ince generating station

Ash from the water-filled hopper of each boiler is removed by hydraulically operated doors and high-pressure water nozzles to a cast iron sluiceway where it is kept in motion by high-pressure sluice nozzles at intervals and is delivered to one of two settling pits. The water is drained from the ash by means of louvres and penstocks in the side of the pit and the ash is then grabbed by an overhead gantry crane into lorries. The water which has been drained off is returned to a reservoir supplying the high-pressure pumps. Ultimately four high-pressure "Hydro-seal" pumps will be installed for the dual purpose of supplying sluice water to the ashing system and also water to the hydro-vactors for dusting.

There are four hydro-vactors and cyclones for each pair of boilers and dust is conveyed to overhead bunkers. Mixer conveyors then damp the dust and deliver it to lorries at a rate of 35 tons/hr each. Ash disposal grounds are available within a radius of about 8 miles from the station.

Station Electrical Supplies

Each unit has a 3·3 kV English Electric type OB33 air-break switchboard fed alternatively from the 5 MVA unit transformer or from one of the station transformers.

Two station transformers, each of 7·5 MVA capacity, are connected to the 132 kV system and each supplies a station switchboard, the two boards being capable of interconnection. Each station switchboard supplies a 750 kVA, 3·3 kV/415 V boiler house transformer and a 1,000 kVA, 3·3 kV/415 V turbine house transformer. The turbine house and boiler house switchboards are capable of interconnection on the l.v. side. Most of the auxiliaries peculiar to an individual unit are supplied from that unit's board.

Each boiler turbine unit has a combined unit control panel giving central control and supervision of the essential auxiliaries. One part of this panel is devoted to the turbine and a control desk is provided for the exclusive use of the boiler operator. Remote soot blowing is carried out from a wing of the unit panel and a comprehensive alarm annunciator panel is installed. A separate supervisory gear cabinet is provided while the turbine oil system is controlled from a separate panel.

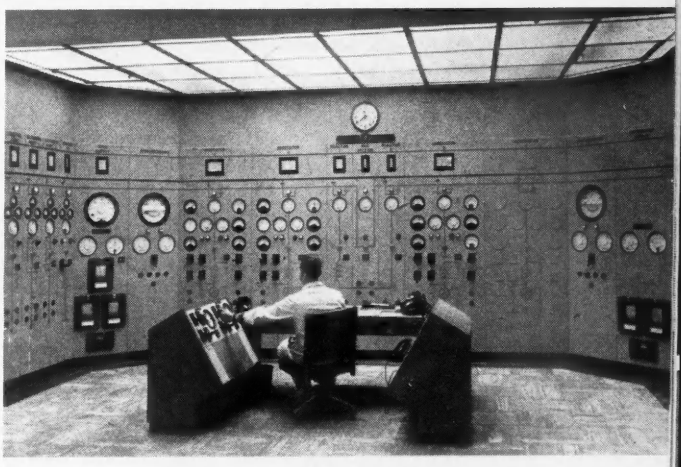
An outdoor 132 kV substation is adjacent to the office

block and is equipped with English Electric air-blast circuit-breakers. Grid connection is via overhead lines to Runcorn, Capenhurst and Ellesmere Port. Control of the four generators by 132 kV circuits is carried out from the main control room where, in addition to the normal automatic voltage regulators, stability limiting devices are provided to maintain sufficient excitation to preserve alternator stability under all conditions.

The consulting civil engineers for the station are Rendell Palmer & Tritton, the main civil contractors being Holland & Hannen and Cubitts, Ltd. No electrical engineering consultants were employed, all the plant design work being carried out by the then Merseyside and North Wales Division of the British Electricity Authority.

The main contractors are:—Boilers, International Combustion, Ltd.; turbo-alternators, the General Electric Co., Ltd.; coal handling, Simon-Carves, Ltd.; ash handling, Babcock & Wilcox, Ltd.; condensing and feed heating, Hick, Hargreaves & Co., Ltd.; steam and feed pipework, Babcock & Wilcox, Ltd.; central evaporators, Aiton & Co., Ltd.; cables, British Insulated Callender's Cables, Ltd.; 132 kV, 3·3 kV and 400 V switchgear, the English Electric Co., Ltd.; and water softening equipment, the Permutit Co., Ltd.

Acknowledgment is due to Mr. A. R. Cooper, Divisional Controller, North West, Merseyside and North Wales Division, Central Electricity Authority, for permission to publish this article, and also to Mr. A. Parker, the station superintendent, for invaluable assistance in the preparation of the material.



The four generators are controlled from the main control room

Electricity in Nigeria

BY OUR LAGOS CORRESPONDENT

THE Electricity Corporation of Nigeria was created by Ordinance on 6th July, 1950, and on 1st April, 1951, took over the following Nigerian Government electricity undertakings:—Western Region: Lagos, Warri and Sapele; Northern Region: Kaduna, Zaria, Yola, Maiduguri, Sokoto, Jos, Vom and Bukuru; Eastern Region: Enugu, Port Harcourt, Calabar, Victoria, Cameroons, Aba and Abakaliki. Up to 1946 these had come under the jurisdiction of the Public Works Department Electrical Branch.

Negotiations were also concluded in 1951 for the transfer to the Corporation of the four native authority undertakings at Ibadan, Abeokuta, Kano and Katsina. These were in a bad state of repair and breakdowns were frequent.

On the formation of the Corporation, it became apparent that considerable alterations and extensions both to the headquarters and to the various undertakings would be necessary. It was decided to introduce regional control—a policy dictated by the size of the country and the lack of adequate communications.

Early Difficulties

Enough has been said to show that, from the very beginning, the Corporation was faced with serious problems arising out of the poor condition of the installations which it had inherited. Although the Government had placed numerous orders for plant and equipment, some of which had been outstanding since immediately after the war, very little new plant had been delivered when the Corporation took over. Unfortunately, also, failure to place certain civil engineering contracts simultaneously with the orders for equipment has had the effect of causing further delay.

Besides proceeding with and expanding the programme of new construction, the Corporation has taken various emergency measures to enable output to be increased. To improve the performance of existing plant and to enable repairs to be carried out with the minimum of delay, substantial orders have been placed for spare parts. Similarly, as a means of augmenting generating capacity as quickly as possible, suitable opportunities have been taken to purchase diesel plant on short delivery, both new and second-hand.

In certain places, notably Lagos, restrictions on further connections had been imposed at a level which provided for some margin between the total demand and the available capacity. The Corporation considered, however, that it was preferable to satisfy the potential demand of as many consumers as possible, even though this meant adding to the risk of occasional failures of supply. In Lagos, the maximum load has been allowed to increase from 6,500 kW to 10,700 kW and the energy generated has increased by 38 per cent.

Certain new projects were handed over to the Corporation in their initial stages. The table on the next page shows the present plant capacity and the extensions being undertaken by the Corporation.

The largest and most important new project at present under construction is the Ijora "B" power station. The site for this station had been selected before the Corporation was formed. It then became apparent that the foundations designed for the new station were unsuitable and work had to be stopped. After new borings had been made and samples of subsoil taken, it was decided that the station would have to be built on a concrete raft; the alternative of finding a new site would have caused even further delay and expense. The originally planned capacity of the Ijora "B" power station was 75,000 kW, but in view of the difficulties encountered it was decided

to install only the two 12·5 MW sets already ordered and under construction and to defer the placing of the contracts for the remaining plant until all alternative possibilities had been explored. With all the unforeseen delays, the first set at Ijora "B" power station is not expected to be in operation before January next, but there will be some

INSTALLED GENERATING PLANT CAPACITY IN kW

	Existing	Under Construction	Projected	Total
WESTERN REGION:				
Lagos	15,250	4,120	25,000	44,370
Ibadan	4,485	1,320	—	5,805
Abeokuta	600	340	—	940
Warri	331	—	—	330
Sapele	250	250	250	750
Benin	—	220	110	330
Oshogbo	—	1,030	—	1,030
EASTERN REGION:				
Calabar	570	250	—	820
Enugu	3,000	1,320	OJI RIVER 10,000	14,320
Port Harcourt	1,084	1,750	—	2,834
Aba	340	1,320	—	1,660
Cameroons	750	—	750	1,500
Abakaliki...	60	—	—	60
Onitsha	—	220	220	440
NORTHERN REGION:				
Kaduna	783	1,320	—	2,103
Kano	3,510	1,320	2,400	7,230
Katsina	100	100	—	200
Maiduguri	95	500	—	595
Sokoto	150	—	—	150
Yola	75	200	—	275
Zaria	1,084	380	—	1,464
Plateau	2,000	(Bulk Supply)	—	2,000
TOTAL	34,516	15,960	38,730	89,206

improvement when the first of the two 1,250 kW diesel sets, now under erection at Ijora "A" power station, is commissioned in the near future.

Another project which the Corporation inherited and which it decided to re-design was the Enugu power station. Plans had been made for a steam station on the River Emene and contracts had been placed for two 5,000 kW turbo-alternators, with associated boiler plant and switchgear, etc. Fortunately, contracts for the civil engineering work had not been placed, for tests carried out at the proposed site revealed that the cooling water available in the dry season would not be sufficient. It was therefore necessary to transfer the whole project to the River Oji, 25 miles from Enugu, where there are ample water supplies. Meanwhile the manufacture of the machinery in the United Kingdom is well advanced and will probably be completed before the civil works.

In order to minimize the high cost of transporting coal, contracts have now been placed for an aerial ropeway from the Hayes Mine at Enugu to the Oji power plant 19 miles away. It is expected that this scheme will cut generating costs appreciably.

In the Northern Region a new steam station with an initial capacity of 2,400 kW is in process of construction at Kano. This will supplement the present station and provide for the increasing needs of the town.

Like the generating installations, the distribution systems taken over by the Corporation were greatly in need of reinforcement and a new construction programme has been initiated. The high voltage distribution system for Lagos was stepped up from 3·3 kV to 6·6 kV and a 33 kV feeder has been erected to supply the new residential area at Ikeja, 11 miles from Lagos. There are at present under construction a 33 kV system linking Oshogbo and Ede and a 66 kV double circuit line linking the power station at Oji River with Enugu.

Work on the installation of the 66 kV single-circuit line linking Oji power station and Onitsha is due to commence shortly, the Onitsha distribution being 75 per cent complete. A temporary diesel supply for Onitsha should be available at the end of this year. At Kano the 33 kV double-circuit line linking Challowa and Dan Agunde has now been completed. The Benin township distribution network is 75 per cent complete and this also will have a supply by the end of 1955. In the Cameroons, the extension to Buea at 22 kV is virtually complete.

Long-term plans provide for a 132 kV link between Lagos and Ibadan. This would be part of a proposed 132 kV and 220 kV network between Asaba, Shagamu, Ibadan and Lagos for ultimate extension to Abakaliki and Port Harcourt, which would tie in the main steam stations of Lagos, Oji River, Port Harcourt and a possible new base load station at Asaba. The establishment of a pit-head generation scheme at Asaba is the subject of economic and technical study, and development on the lines indicated above will be dependent on the results of this investigation. In the meantime, the preliminary survey of the 132 kV Lagos-Ibadan line is under way. The provision of such interconnection systems will cost a great deal. Energy will be transmitted at voltages much higher than the initial load warrants, since the consumption of power in most load centres is not comparable with that in countries where modern techniques have been developed. In 1950 the annual consumption of electricity in Nigeria was only 4 kWh per head of the population. One of the foremost concerns of the Corporation is to promote wider use of electricity, both by industrial and by domestic users.

The main incentive to increased consumption would be the provision of power at cheap rates and the Corporation has this aim continually in mind. Investigations are proceeding into the possibility of developing the natural resources of the country and in particular the hydro-electric potential of the River Niger and in the Cameroons highlands. Here again, before any major scheme could be undertaken it would be necessary to make certain that the considerable capital required was available. The supply of electricity and the growth of industry are interdependent, and one cannot be considered without the other in long-term planning and allocation of capital resources for the development of Nigeria.

Kurra Falls

The Senior Resident, Plateau Province, Mr. C. R. Niven, formally opened the Jekko No. 2 power station about 60 miles from Jos recently, at the invitation of the Nigerian Electricity Supply Corporation, Ltd. This company was formed in 1929 to acquire and complete the construction of a hydro-electric station at the Kurra Falls to supply power to the tin mines on the Bauchi Plateau in Northern Nigeria. The new Jekko station has a capacity of 4,000 kW and is designed for automatic control.

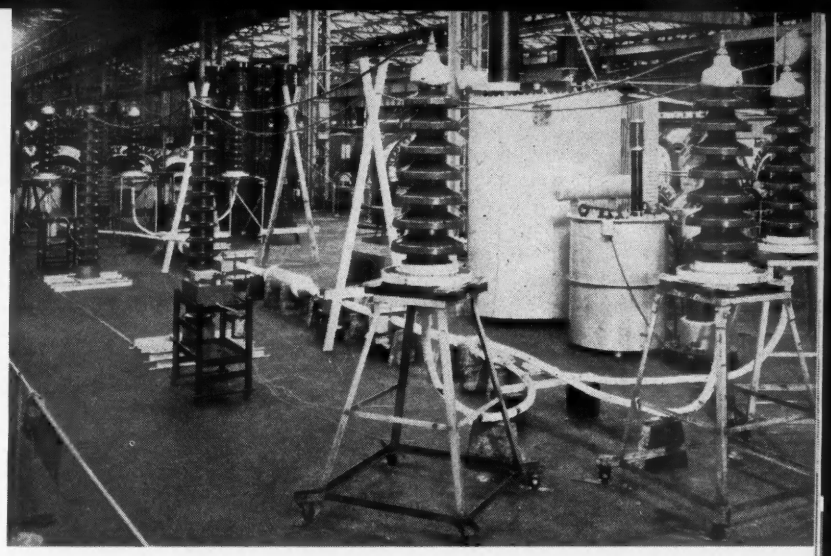
At the opening ceremony, Mr. Harvey Brace, the chairman of the company, after welcoming the guests, gave a brief history of Kurra Falls. He said that Col. Boyes, who was sent by his principals to peg the river areas of the plateau in March, 1927, was the first white man to walk over the Kurra Hills. In 1927, when the Kurra Falls scheme was under way, the company had the perspicacity to foresee that further development at the Jekko Falls might some day be required.

Rural Supplies in N.S.W.

Opening the annual conference of the New South Wales Division of the Primary Producers' Union in Sydney, Mr. J. J. Cahill, the Premier, said that Australia was undergoing an agricultural revolution. Electricity would be supplied to 75 per cent of the N.S.W. farms within five years. Since 1946 some 16,000 miles of new power lines had been erected in country districts.

132 kV Oil-Filled Three-Core Cable

NEW HENLEY DEVELOPMENTS



Impulse system prepared for testing, hot, the 132 kV oil-filled cable and joints at Henley's Research Department, Gravesend

HITHERTO oil-filled cables to operate at voltages as high as 132 kV have been single-core; 66 kV has been the upper limit for three-core oil-filled cables, using the recognized maximum operating stresses. It is evident that considerable economies in jointing are secured by substituting a three-core cable for a trefoil assembly of single-core cables.

W. T. Henley's Telegraph Works Co., Ltd., have been conducting research into materials and processing with a view to raising the limit for the use of three-core oil-filled cables and they have succeeded in constructing cables for up to 132 kV.

An important step was the recent completion by the company for Belfast of two 3-mile 0·3 sq in three-core 110 kV oil-filled cable feeders, to be operated in parallel, having a maximum working stress of 85 kV/cm, each capable of transmitting 75 MVA. The following type approval tests for this contract were carried out on short cable systems made up of single- and three-core cable, a straight-through joint, trifurcating joints and sealing ends:—

(*a*) Application of 220 kV a.c. 50 c/s between conductors and lead sheath for 15 minutes.

(*b*) Loading cycle test of twenty daily heat cycles of six hours' heating and 18 hours' cooling, the conductors being raised to 90 deg C with a continuously superimposed voltage of 127 kV.

(*c*) Impulse test consisting of ten negative and ten positive impulses of 545 kVp nominal 1/50 wave.

In addition, the following tests were completed on lengths of single- and three-core cables:—

(*d*) Dielectric thermal resistance.

(*e*) Bending test of three successive cycles over a barrel the diameter of which was twenty times that of the cable. After this the high-voltage test of 220 kV was again applied satisfactorily.

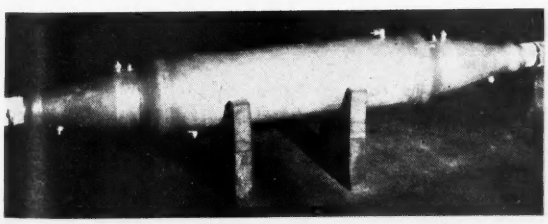
The results obtained, together with the results of intensive investigations on the materials themselves and their processing, indicated that a similar design of 132 kV cable could be satisfactorily produced, operating at a higher stress, which would have adequate margins over the specified withstand values.

Accordingly, a design for a three-core 132 kV cable having a 0·2 sq in conductor was prepared to operate at a design maximum stress at the conductor of 100 kV/cm. The thickness of dielectric is 0·515in and that of the lead sheath 0·125in, the overall diameter of the cable being 4·22in. The conductors are screened by means of semi-conducting paper.

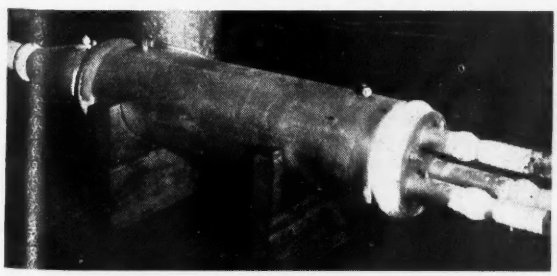
Simultaneously, development work has been carried out on the accessories for use with this design of cable. So far as the straight-through joint is concerned this work has resulted in a design, incorporating paper rolls, having a length and diameter only 150 per cent of those of the corresponding single-core joint used for the same size of conductor for many years.

A similar construction having the same advantages is utilized in the trifurcating joints which are used on cables in which the length of single-core tail must be greater than, say, 30ft to meet local requirements. Where the length of tail is less than 30ft the trifurcating joint can be dispensed with and a dividing box of small weight and dimensions is employed, the three individual cores of the three-core cable being passed through the box and into reinforced lead tubes to produce the single-core tails. The factory-applied insulation is not affected in this procedure and there is no "joint" in the usual sense of the term. This form of trifurcation is very compact.

To obtain data on the combination of cable and accessories described short systems were made up and subjected to a complete range of tests, some of which we saw last week at the company's Research Department at Gravesend. For short-time service transient requirements a short



Straight-through joint for 132 kV three-core cable



Trifurcating joint for taking off three single-core tails

system was made up consisting of six sealing ends, one straight-through joint, one trifurcating joint, and one dividing box. By means of ring type transformers fitted over the three-core cable, with the individual cores short-circuited, the system was heated to a conductor temperature of 85 deg C in the three-core cable and each core was subjected to impulse tests involving ten negative followed by ten positive impulses at each voltage. After covering the withstand requirements of 640 kVp with a 1·6/50 wave the applied voltage was raised in steps to determine the ultimate strength of the system. Ample margins were obtained over the withstand values, involving the application of over a hundred impulses on each of the cores before breakdown occurred.

Normal service conditions are usually simulated by the application of loading cycles with a simultaneous application of a.c. over-voltage. A sample similar to that used for the impulse tests was made up, but about 40 yd of three-core cable was used in this case, the heating current being supplied by ring type transformers on the tails and a superimposed voltage of 150 per cent of working voltage was applied continuously. Twenty heat cycles each of six hours' heating and eighteen hours' cooling were applied with a conductor temperature of 90 deg C in the cable. At this stage 190 kV 50 c/s a.c. was applied to the system for a period of twenty-four hours with no apparent effect. In view of the perfect stability, the conductor temperature was then increased to 100 deg C for twenty cycles, 110 deg for twenty cycles and to 120 deg for a further twenty cycles with satisfactory results.

Bending tests generally in line with British Standards requirements were carried out using barrel diameters of 83in for the three-core cable and 40in for the single-core cables; subsequent dissection and examination showed that there was complete freedom from creases and tears in both instances.

In order to demonstrate the adequacy of the mechanical design, samples 5 yd long of both single- and three-core cables were subjected to twice the hydraulic working pressure for seven days without effect. The pressures were then raised to bursting point and in each instance showed ample margins over the long-time test values.

For certain conditions of installation it is necessary to divide the cable system into oil sections and for this purpose stop joints are used. Also, it is sometimes advantageous to use oil-immersed sealing ends for switchgear, reactors and transformers. To cover these aspects a system was made up for impulse tests consisting of an outdoor sealing end, a stop joint, the minimum length of single-core cable and an oil-immersed sealing end installed in an oil tank.

The cable conductor was heated by transformers to give a temperature in the region of 85 deg C and impulse tests were applied, ten negative and ten positive at this temperature, commencing at the withstand value of 640 kVp. The voltage was increased until breakdown occurred. Again the margins were adequate, the values obtained being in line with those obtained in the three-core cable tests.

The results of these tests on systems having a design maximum stress of 100 kV/cm, both from the mechanical and the various electrical aspects, show that the same satisfactory service will be obtained from a full-scale commercial installation as has come to be expected of all oil-filled cable systems.

A notable example in which the use of underground cables is dictated by route conditions occurs on the 132 kV system of the North West, Merseyside and North Wales Division of the C.E.A. at Manchester, where three three-core 132 kV oil-filled cables each approximately 3·2 miles long will link up with an overhead line to transmit energy from the Agecroft power station to a new supply point at Bloom Street, Manchester.

Dividing box for use when short lengths of tail are involved

The contract for supplying, laying, jointing and terminating these cables has been placed by the C.E.A. with Henley's. The cables will be operated in parallel, each being capable of transmitting 70 MVA. They will constitute the first three-core oil-filled cable system in the United Kingdom to operate at 132 kV.

Clean Air Bill

Last week the text was published of the Clean Air Bill in which the Government gives effect to some of the recommendations of the Beaver Committee on Air Pollution (*Electrical Review*, 3rd December, 1954). It is obtainable from H.M. Stationery Office, price 1s.

The first section prohibits the emission of "dark smoke" from the chimney of any building, subject to certain observations. Dark smoke is defined as "smoke which, if compared in the appropriate manner with a chart of the type known at the date of the passing of this Act as the Ringelmann Chart, would appear to be as dark or darker than shade 2 on the chart." In any proceedings under this section it will be a defence to prove that the contravention was solely due to the starting up of a cold furnace, the failure of a furnace or ancillary apparatus, or that suitable fuel was unobtainable. Seven-year exemptions are given in cases where the nature of a building or equipment is the cause of contravention and it is impracticable to alter the arrangements.

It is required that new pulverized fuel furnaces and those burning ten tons or more solid fuel per hour shall be of a smokeless type and shall be fitted with grit and dust arresting plant. Provision is made to require occupiers of buildings in which such furnaces are installed to keep records of grit and dust emission. Local authorities are empowered to call for information about furnaces from occupiers of buildings.

Smoke control areas may be declared by local authorities and the conditions governing these are laid down in the Bill. In such areas owners or occupiers of private dwellings may be repaid expenditure involved in complying with the regulations to the extent of 70 per cent or more. Special provisions are made for colliery spoilbanks, railway locomotives, vessels and Crown premises, etc. Under the Bill building bye-laws may require the provision in new buildings of such arrangements for heating and cooking as are calculated to prevent, so far as is practicable, the emission of smoke. Local authorities are empowered to conduct or contribute towards the cost of research relevant to air pollution and to engage in publicity on the subject.

Penalties are prescribed for contravention of the regulations ranging up to £10 for the occupiers of private dwellings and up to £100 for others.

The Palais des Nations, Geneva

"Peaceful Uses"

Geneva Atomic Energy Conference and Exhibition

ABOUT eighty nations are taking part in the International Conference on the Peaceful Uses of Atomic Energy which opens at Geneva next Monday and continues until 20th August. The official delegation from Great Britain will consist of Sir John Cockcroft, director of the Atomic Energy Research Establishment, Harwell; Sir Christopher Hinton, managing director of the Atomic Energy Authority Industrial Group; Dr. J. F. Loutit, Medical Research Council and Agricultural Research Council; Sir George Thomson (Royal Society), representing the universities; and Dr. Willis Jackson (Metropolitan-Vickers), representing British industry. In addition Sir Edwin Plowden, chairman of the United Kingdom Atomic Energy Authority, will attend, and there will be a number of advisers to the delegation from research and industrial establishments. In all there will be about 160 people, excluding industrial representatives attending the exhibitions which have been organized in connection with the conference.

Nearly 1,000 papers on all aspects of atomic development and use are to be presented and just over 100 of them will be by United Kingdom authors; of the latter 67 will be read and the remainder will be included in the report of the proceedings to be published later. The papers have been classified in groups to be dealt with at plenary and sectional sessions. These groups include the need for a new power source; the role of nuclear energy; the building of a nuclear energy enterprise; health and safety aspects; production and use of isotopes; problems relating to large quantities of radioactive substances; research reactors and power reactors; production technology of special materials; chemical aspects of nuclear reactors; liquid metals technology; problems of waste treatment and disposal; various chemical and metallurgical aspects of reactor operation; industrial uses of fission products; and the application of isotopes in process and quality control.

Papers from United Kingdom

Among the papers to be presented by British authors are the following:—

"The World's Need for a New Source of Energy," by E. A. G. Robinson (Cambridge University) and G. H. Daniel (Ministry of Fuel and Power); "The Role of Nuclear Energy in Relation to Other Methods of Electricity Production," by J. M. Kay (Kennedy & Donkin); "The Contribution of Nuclear Power to United Kingdom Energy Requirements—up to 1975," by Sir John Cockcroft (U.K.A.E.A., Harwell); "The Cost of Power and the Value of Plutonium from Early Nuclear Power Stations," by J. A. Jukes (U.K.A.E.A., London); "Capital Investment Required for Nuclear Energy," by J. M. Hill and S. W.

Joslin (U.K.A.E.A., Risley); "Radiological Hazards from an Escape of Fission Products and the Implications in Power Reactor Locations," by W. G. Marley and T. M. Fry (Harwell); "Recent Developments of Radioisotope Uses in Industry," by Dr. Henry Seligman (Harwell); "Long-Term Aspects of Fission Product Disposal," by H. Glueckauf (Harwell); Survey Paper on Research Reactors, by R. Bretscher, J. V. Dunworth, H. J. Grout and J. F. Loutit (Harwell); "Experience with B.E.P.O.," by R. F. Jackson (Harwell); "The Experimental Facilities of E.443," by H. J. Grout and F. W. Fenning (Harwell); "Fuel Cycles," by J. V. Dunworth and F. W. Fenning (Harwell); "Experimental Studies on Fast-Neutron Reactors at A.E.R.E.," by L. R. Shepherd (Harwell); "The Dounreay Fast Reactor Project," by J. W. Kendall and T. M. Fry (U.K.A.E.A., Risley and Harwell); "The Graphite Moderated Gas-Cooled Pile and its Place in Power Production," by Sir Christopher Hinton (U.K.A.E.A., Risley); "Infra-Red Methods for the Analysis of Heavy Water," by J. Gaunt (Harwell); "Chemical Aspects of Nuclear Reactors," by R. Hurst and J. Wright (Risley); "Handling Liquid Metals" by S. Bauer (Rolls-Royce); "The Measurement of Dissipation of Effluent in the Sea I," by H. Seligman (Harwell); "The Discharge of Radioactive Waste Products in the Irish Sea II," by H. J. Dunster (Harwell); "The Discharge of Radioactive Waste Products in the Irish Sea III," by D. R. R. Fair and A. S. McLean (U.K.A.E.A., Windscale and Risley); "Neutron Spectrometers Based on Pulsed Sources," by E. R. Wiblin (Harwell); "Plutonium-Water Critical Assemblies," by C. C. Horton and J. D. McCullen (Harwell); "Method for Calculating the Critical Mass of an Intermediate Reactor," by Mrs. M. F. Mandl and J. Howlett (Harwell); "Long-Term Reactivity Changes in Natural Uranium Reactors," by D. J. Littler (U.K.A.E.A., Harwell); "Radiation Injury and Protection: Maximum Permissible Exposure Standard," by W. Binks (M.O.H. and M.R.C.); "Control of Radiation Hazards in the Operation of Medium-Powered Experimental Reactors," by W. G. Marley and B. S. Smith (Harwell); "The Radioactive Survey of the Area Surrounding an Atomic Energy Factory," by D. R. R. Fair and A. S. McLean (Risley and Windscale); "The Production of Beta-ray Sources for Industrial and Clinical Use," by P. E. Carter and L. V. Myerscough (R.C.C., Amersham); "Application of Radioisotopes to Leakage and Hydraulic Problems," by J. L. Putman and S. Jefferson (Harwell); "Development in Thickness Gauges and Allied Instruments," by J. L. Putman (Harwell); and "Possible Role of Thorium in Nuclear Energy," by J. V. Dunworth (Harwell).

The Exhibitions

Great Britain is making important contributions to the two exhibitions. One of the exhibitions, in the Palais des Nations, is purely scientific and intended principally for members of delegations. Here the Atomic Energy Authority's display, covering 3,000 sq ft, will be mainly concerned with nuclear reactors for research and for the generation of power, and with the special instrumentation developed in this field.

Models of one of the Calder Hall reactors (3ft 11in by 2ft 6in), of the Harwell heavy water reactor E443 ("DIDO") now being built (7ft 6in sq by 8ft 6in high), and of the second Harwell heavy water reactor RE775 ("PLUTO") also now under construction (4ft 6in sq by 5ft 6in high) are included. The instruments on view have been developed in the Authority's Research and Industrial Groups for reactor control, special recording work and for dealing with the raw materials of the atomic age.

The second exhibition, in the Palais des Expositions, is designed for the general public as well as delegates. The United Kingdom Atomic Energy Authority exhibit, which occupies over 7,000 sq ft, gives a comprehensive survey of the peaceful applications of atomic energy in this country. A detailed model of the Calder Hall power station measures 17ft 2in by 4ft 3in and one of the breeder reactor experimental power station at Dounreay measures 7ft 6in by 6ft 6in; "DIDO" (or E443), the Harwell heavy water experimental reactor, will be shown in a model 19ft by 15ft 4in and 5ft 6in high.

A wide and spectacular variety of models and working apparatus will tell of the latest advances that have been made in the uses of radioactive isotopes, of which Great Britain is the largest exporter in the world. Much of the display is devoted to industrial and medical devices and reference is also made to agricultural research. There is also a display of surveying equipment.

The Atomic Energy Authority's exhibits have been designed to integrate closely with those of British firms associated with atomic development, which cover an area of nearly 20,000 sq ft. They are divided into two sections, one concerned with the instrument industry and the other with heavy industry. A central inquiry desk with interpreters and secretarial staff will serve the whole United Kingdom exhibit. The firms taking part are:—

Instrument Industry Section: Cambridge Instrument Co., Ltd., E. K. Cole, Ltd., Ericsson Telephones, Ltd., General Radiological, Ltd., Hobson, Ltd., Isotope Developments, Ltd., Labgear (Cambridge), Ltd., Nuclear Engineering, Ltd., Philips Electrical, Ltd., Scientific Instrument Manufacturers' Association of Great Britain, Ltd. (Automatic Coil Winder Co., Ltd., Chance Bros., Ltd., A. C. Cossor, Ltd., Burndept, Ltd., W. Edwards & Co. (London), Ltd., Electronic Instruments, Ltd., Fleming Radio (Devs.), Ltd., Nash & Thompson, Ltd., Panex Equipment, Ltd., Salford Electrical Instruments, Ltd., R. A. Stephen & Co., Ltd., Sunvic Controls, Ltd., and Twentieth Century Electronics).

Heavy Industry Section: Aiton & Co., Ltd., Babcock & Wilcox, Ltd., English Electric Co., Ltd., General Electric Co., Ltd., Hayward Tyler, Ltd., Metropolitan-Vickers Electrical Co., Ltd., Taylor Woodrow, Ltd., Tube Investments, Ltd., Vokes, Ltd., Nuclear Power Plant Co., Ltd., Elliott Bros. (London), Ltd., and English Steel Corporation, Ltd.

The chairman of the Executive Committee for the exhibition is Mr. Eric H. Underwood, O.B.E., director of public relations to the United Kingdom Atomic Energy Authority; Mr. N. C. Pratt is the honorary co-ordinator of the Industrial Section and Mr. N. H. Campbell the honorary organizer.

Batti-Wallahs' Society

The progress of education was the subject of the talk given by Mr. J. Brown, Education Officer of the London County Council, who was the guest speaker at last week's luncheon of the Batti-Wallahs' Society. He spoke of the development of compulsory education, the organization under the 1944 Act, and the recent establishment of the first comprehensive school at Kidbrooke. Referring to the shortage of scientists and technologists, he said that the intake of schools was growing rapidly and that in four or five years larger numbers of students would be available for industry. Industry, however, was not the only branch which suffered from manpower shortage; there was also an unsatisfied demand for teachers.

Following custom, there will be no luncheon of the Society in August.

WORLD ELECTRICAL MARKETS

Industrialization in Egypt

By D. SILVERMAN, D.Sc., A.M.I.E.E.(Cairo)

THE trend towards the industrialization of Egypt to meet at all costs the needs of the fast growing population has had a marked effect on the electrical industry. The need for more electricity is becoming more urgent every day, with a consequent increase in power schemes, electrical imports, electrical manufacture, and demands from the domestic market.

In 1939, the total production of Cairo power stations was some 70 million kWh; the figure reached in 1953 exceeded 310 million kWh. For Alexandria, the respective figures were 50 million and 220 million. In the rest of the country electricity output, though small in comparison with the two main cities, has reached five times the pre-war figures.

To meet the increased demand new electrification schemes have been carried out since the end of the war and others are in hand. The main schemes for the Cairo Zone are as follows:—

(a) North Cairo power station, housing two turbo-alternators of 10 MVA, one of 20 MVA, and two of 30 MVA, a total of 100 MVA. This is now the largest thermal power station in the Middle East. Steam is produced by ten oil-fired boilers having a total capacity of 700 tons of steam per hour at a pressure of 64 kg/sq cm (910 lb/sq in).

The construction of this station has inaugurated a series of large electrification schemes in Cairo, with a 66 kV network spreading over a distance of some 30 miles. A 25-year plan has been elaborated by the Cairo Electricity and Gas Administration to bring the total power of the Cairo area up to 400,000 kW in 1975, and comprising:

(b) South Cairo power station with an ultimate capacity of 240,000 kW. This is now under construction and 120,000 kW of plant will be in operation in 1957.

(c) El Tabeen power station with a capacity of 45,000 kW.

(d) Several substations, ranging between 15,000 kVA and 60,000 kVA along the 66 kV ring main, to step down the transmission voltage to 11 kV.

(e) Iron and steel works near Cairo South power station.

(f) Electrification of the Cairo-Helwan railway line (20 miles) which will be fed from the above power station.

The power stations will eventually be linked by a 132 kV overhead network to other generating plants in the Northern Delta and Upper Egypt.

The provision of electric power is not confined to the capital; it is spread over the whole territory. The Talkha 37,500 kW power station which has just begun operations with three steam turbine sets is designed to assist the North Delta irrigation schemes. Nag Hamadi, Edfu, and many municipalities have plants totalling over 30,000 kW all now working to their full capacity.

By far the most important scheme is the hydro-electric station. The civil work on this is now well advanced and the erection of equipment will soon begin. The total installed power will be 345,000 kW derived from seven main 46,000 kW alternators driven by Kaplan turbines and two 11,500 kW units. This station will operate throughout the year, but the total power will be only 90,000 kW during the flood period because of the lower water level. The total energy to be produced is estimated at 1,760 million kWh annually.

The generated voltage of 11 kV will be raised to 132 kV to feed through an overhead transmission line a chemical manure factory near Aswan and several pumping stations in Upper Egypt. The manure factory will have a load of 220,000 kW and will consume some 1,350 million kWh a year; it will produce annually 370,000 tons of ammonium nitrate. It is hoped that the complete scheme will be in full operation towards the end of 1959.

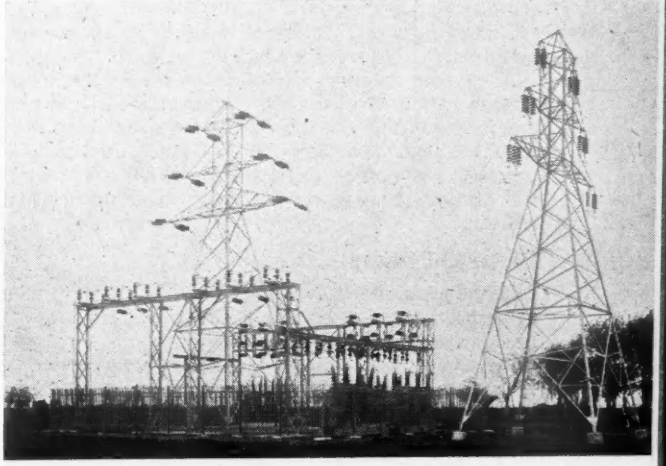
Aswan Dam Scheme

Many other large projects are now under study, among which is the Aswan High Dam scheme. The present dam can deal with only some 5 billion cubic metres of water per year, which is a very small proportion of the total volume of water carried by the Nile, some 100 billion cubic metres per year, half of which is now lost to the sea. When the flood is small, the discharge of the river falls to 45 billion cubic metres, and the summer crops suffer from lack of water, while during heavy floods, with a discharge of 130 billion cubic metres, the land is exposed to the danger of flooding.

Studies are now being made for the building of a reservoir 100 metres high 7 km south of the Aswan Dam. This will have a capacity of 135 billion cubic metres and thus be able to retain all the water carried by the flood, increasing tremendously the amount of irrigation water to cope with the needs of the ever-increasing population. The electric power which would be produced by the new barrage is estimated initially at 6,000 million kWh per year. The Nile water level will also be stabilized, with a consequent improvement in navigation.

There are many other projects still in a very preliminary stage of study, such as that of the Kattara Depression.

A 66 kV switching station in the Northern Delta



Excavation work in progress on the Aswan hydro-electric undertaking

Not far from the Delta, in the western desert, this depression, with a superficial area of 19,500 sq km, lies some 80 metres below the Mediterranean sea level. If the sea water is allowed to run into the depression, forming an artificial lake with natural evaporation, some 2,900 million kWh could be produced per annum, with generating plant of about 330,000 kW. There are of course many financial and technical difficulties to be overcome before this scheme can be accomplished.

The Egyptian Government keeps in constant touch with most world experts on electrification, especially Electricité de France, to secure solutions to all problems of production, transport and distribution of electricity for the rapid industrialization of the country, and to find sources of energy other than coal and oil, the former being totally absent and the latter scarce in Egypt. It is also essential to standardize and co-ordinate all sources of production and distribution of electric power, to reach a stage when all the country will be interconnected by one common network, the advantages of which are obvious.

Along with the drive toward electrification, there is also a rapid growth of telecommunication facilities, and a vast programme is now under execution for a complete modern telephone and telegraph network, including television channels. In most towns telephony will be fully automatic and will all be connected through a national dialling scheme.

Electrical Manufacture

While great efforts are being made by the Government to secure execution of the electrification projects, little has been done so far in the manufacture of either machinery or equipment but the following industries are worthy of notice.

There are two important incandescent lamp factories, one built by Philips in Alexandria in 1944, and the other by the Electricity and Ice Co. in Ismailia in 1933. The annual production of these two factories is estimated at 3 million lamps, the full capacity being some 5 million. The lamp consumption of the country is at present 5½ million of which one million are special lamps (for cars, cinema projectors, etc.). All the raw materials used in the manufacture of lamps are imported, but the glass bulbs are manufactured locally and assembly is by the most modern methods.

The production of equipment began in Egypt in 1931. The production of so-called "neon" tubes can be estimated at some 50,000 metres per year. Certain streets in Cairo and Alexandria are comparable with the main streets of most modern cities as regards decorative lighting. The tubes, including all ancillary gear, are wholly manufactured in the country, and are now exported to neighbouring states, such as the Sudan and Saudi Arabia.

The plastics industry was inaugurated in Egypt in 1929, and the manufacture of accessories such as switches, bell pushes, sockets and plugs, lampholders, etc., takes a large share of its capacity, which exceeds the needs of the local market. The production cost is very low, but the quality has not yet attained the standards of foreign products and large quantities of accessories are imported, mainly from France, Germany and Italy, where they can be obtained at very low prices.

A scheme is now being studied, and will be realized in the near future, for the local assembly of telephone apparatus from imported parts, with the exception of cases and plastic mouldings, which will be produced locally.

Most electrical installations in buildings are done with special paper-insulated tubes of zinc-leadfoil, similar to the "Bergmann" type conduits used on the Continent. These are now manufactured very cheaply and satisfactorily for all sizes up to 36 mm diameter.

The manufacture of storage batteries began in Egypt in 1934, but the industry has not yet reached the standards of quality of the foreign products. Some 30,000 units for

cars and radio sets are being produced annually, though the production capacity may well be trebled, and imports steadily increased from £E37,000 in 1939 to £E280,000 in 1953. A great handicap is that all raw materials, such as lead, antimony, lead oxide and litharge are imported, although wooden or plastic separators are now made locally.

A new wire and cable industry has been started with mixed Egyptian and French capital. French experts from the Tréfileries et Laminoirs du Havre and the Société Electrocâble have completed the first stage of the works, now producing 2,000 tons of bare copper cable and v.i.r. and p.v.c. wire per year. It is expected that the production this year will reach 5,000 tons, while after five years it will cope with the needs of the local market for all kinds of wire and cable. In 1953 imports of cables amounted to 9,000 tons with a value of some £E1,800,000.

From the above it may be gathered that although great efforts have been made in certain branches of the electrical industry, the fact remains that Egypt is still compelled to import most of her electrical material from abroad. This is chiefly due to the scarcity of raw materials and the lack of regulations for the standardization of finished products.

Import Trade

The total general imports of the country rose from £E33·8 million in 1939 to £E175 million in 1953; taking into account the average cost index of 1953 against 1939, foreign trade as a whole has changed very little, but the proportion taken by electrical goods has increased from 2·3 to 4·4 per cent. The largest shares of the electrical import trade went to France and Western Germany, while that of Great Britain fell from 30 per cent in 1939 to 18 per cent in 1953. This has been due to the very keen interest taken by the former nations in Egyptian projects, and to the strong competition in the local market.

Electrical Imports	1939	1953
	£E	£E
Electrical machinery	99,144	567,000
Primary cells and accumulators	60,262	590,883
Lamps	59,041	282,496
Telephone and radio apparatus	185,370	1,743,151
Apparatus for domestic use	24,630	406,762
Cables and wires	116,037	1,775,850
Sundry accessories and apparatus ...	246,129	2,374,991
Total value in £E	790,613	7,741,133
Total weight in tons	9,470	20,009

Household appliances are absorbing an increasing share of the trade, half of this class of imports being of domestic refrigerators, mainly imported from the United States. Similarly, radio receivers are mostly obtained from Philips, Holland. This concern is also providing half of the lamp imports, in addition to its own factory in Alexandria.

For these, as well as for other electrical material, the most important selling factors are publicity, a widespread selling organization with branches all over the territory, good servicing after supply, extended credit terms and, above all, reduced prices. Prospects for the future are good, both in the industrial and consumers' markets, and there is every reason to believe that serious efforts now to meet competition will prove fruitful in the long run.

Carrier System on 300 kV Line

A COMPLETE power line carrier communication system for the Kitimat-Kemano project of the Aluminum Company of Canada in British Columbia has been supplied and installed by the General Electric Co., Ltd. The normal line voltage of the transmission system is 300 kV.

The power line carrier equipment is designed to operate on an inter-feeder basis. The signals are transmitted between one phase of one feeder and the corresponding phase of the other feeder. The wave traps are rated for 1,600 A steady line current. The system, in addition to providing the usual speech and signalling facilities, also provides uni-directional transfer tripping facilities, so that if a fault occurs anywhere in the overhead lines the feeder breaker at Kemano is tripped.

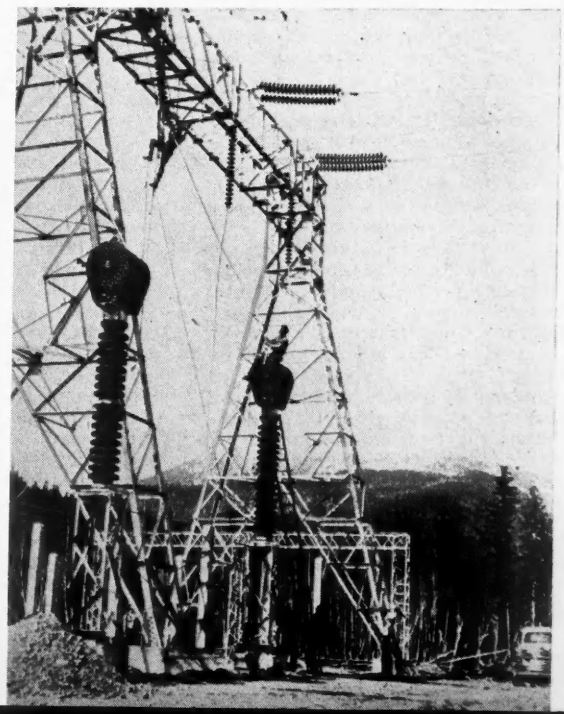
The two sites are linked by three duplex telephone channels, one of which provides a direct connection between the two control desks for the control engineers. The remaining two channels work between the telephone exchanges at the two stations, and provide for fully automatic communication between the subscribers thereon. A telemetering channel also operates from Kitimat back to Kemano to indicate the line voltage received at Kitimat.

All common equipment is fully duplicated and change-over to stand-by equipment is completely automatic. The power line carrier equipment is readily extensible to an ultimate capacity of five circuits. It is also provided with additional automatic gain control facilities to maintain the level of the circuits at their nominal value even during the unusually severe weather conditions experienced.

The a.c. supply for this equipment is obtained from a four-machine generator set. Under normal conditions the local a.c. power supply drives a three-phase induction motor coupled to a single-phase alternator by means of a flywheel. In the event of a supply failure, a stand-by d.c. motor is energized from the station storage battery and drives a single-phase alternator. When a change-over takes place the flywheel on the main set maintains the output from the main alternator until the stand-by machine has run up to speed.

Each communication channel is of 4 kc/s, and consists of a speech channel of from 300 c/s to 2,700 c/s and a telephone signalling channel of 3,060 c/s, leaving space for the accommodation of six super audio signalling channels in the remaining part of the frequency band.

Setting up the power line carrier coupling equipment at Kitimat ; the two wavetraps are shown in the foreground



PARLIAMENTARY REPORT

In the House of Commons economic debate which followed the announcement of the Government's decision to slow down capital expenditure and increase hire-purchase deposits, Mr. Hugh Gaitskell asked the Chancellor of the Exchequer (Mr. R. A. Butler) to clarify his intentions concerning the capital investment programme of the nationalized electricity industry.

Mr. Gaitskell said that a few days ago the Minister of Fuel and Power announced a big programme of increased oil consumption in place of coal. Oil companies, the Minister had said, were to provide an extra 6 million tons of fuel oil in the next five years. To produce that fuel oil they would presumably have to have increased refinery capacity. Was the refinery programme to be affected by the cut? In 1954, the Minister announced investment in the years up to 1960 of £1,440 million in electricity. He had said then that the programme had been carefully examined by his Department, that it was discussed with the Boards concerned, and that he was satisfied it was on the right lines. Was that to be sacrificed? There was also the £1,200 million development plan for the railways, for which £800 million was to be borrowed. Was the House to assume that this would remain unchanged?

Mr. Butler, when he came to reply, said that his statement did not affect any programme already announced unless a nationalized industry could with reason and without doing any harm slow it up so that we should not be trying to do too much. Certainly, the coal mines must have their full investment because coal was our major economic problem at the present time. Secondly, the Government must press ahead with nuclear power, for civil purposes especially, and, thirdly, with oil, if only to supplement our coal resources which were not sufficient to keep pace with our rising industrial production. The railway modernization programme must also go on.

The nationalized industries themselves had undertaken to defer, for periods varying from three to twelve months, certain projects.

The electricity industry was prepared to defer certain projects, mainly in relation to distribution, because generation could be held up only with danger to the regularity of the supply to industry. The industry would also reduce working capital needs by economy in stocks, appliances, etc., and by applying to internal needs certain superannuation moneys which would otherwise be invested outside the industry. The Central Electricity Authority had already announced that, as a general contribution towards meeting our economic needs, it would make provision, in raising charges, for financing part of its capital expenditure without borrowing.

On the subject of the increased restriction on hire-purchase, Mr. Butler asked the House to remember the impact which this would have on the metal-using sector of the economy. It was vital to remember that we depended upon this sector not only for the export trade, for our industrial programme, but also for many "gadgets"—television sets and the rest—which were of such importance to the housewife and the home.

Referring to his request to the banks to reduce credit facilities, the Chancellor said that bank deposits had fallen by more than £200 million or more than 3 per cent and the position with regard to bank advances was quite unsatisfactory. He said the reason for bank advances being considerable was partly that the banks, in the period in which he originally asked them to start the "credit squeeze," were financing in particular the gas and electricity undertakings. Now that the authorities had arranged for the nationalized undertakings to go on to the market for the money they wanted, and not to depend so much on bank advances, he was hoping that a distinct source of embarrassment to the banks in operating the "squeeze" would have been removed.

Mr. Hugh Fraser welcomed the decision that the gas and electricity industries should go to the money market. He said that over the next five years the programme in the public sector for producing energy would amount to no less than £2,000 million. Also during that period we should use foreign exchange either for imported coal or oil, or in respect of coal not exported, amounting to at least £100 million a year. It was vital that, in these circumstances, some economies should be made in the programme. One of the first things to be considered was the amount of money being spent to-day on hydro-electric works. It was not intelligent to invest such large sums of money on the peak programme for producing electricity. We were investing on 11 per cent load-factor stations such as the new Welsh stations, which would cost about £20 million.

Replying to the debate for the Government, Sir Edward Boyle, Economic Secretary to the Treasury, replied to suggestions made by some Members about the effect of the Government's new policy on the educational developments. He said there was no truth in the allegation that the Government would cut down the plans for higher technological education which were announced only the previous week.

Imported Coal

Mr. Nabarro asked the Minister of Fuel and Power how much imported foreign coal would be consumed by the Central Electricity Authority power stations this year out of the total consumption of 44 million tons of coal for public electricity generation; how far the Authority would import foreign coal direct, paying the full economic price, and how far the National Coal Board would carry the loss of £2 per ton.

Mr. Geoffrey Lloyd said the Authority was expected to consume about 5 million tons of imported foreign coal during 1955. The National Coal Board would make all the purchases abroad and spread the extra cost over all consumers.

Parallel Running

Mr. Nabarro asked for the respective installed capacity of public and private electricity generating facilities at 30th June, 1955; and, in view of the recent Government decision covering revision of capital investment programmes in the nationalized industries, what steps the Minister was taking to improve co-operation between public and private generators working in parallel, or otherwise.

Mr. Geoffrey Lloyd replied that public generating capacity totalled 21 million kW, and, so far as could be estimated, private plant capacity about 4½ million kW. The recent decision regarding capital investment did not call for any exceptional steps to improve the existing co-operation between public and private generators.

Tax on Water Heaters

Mr. Coldrick asked the Secretary to the Treasury whether he would now give further consideration to the possibility of removing purchase tax at present payable on electric and gas geysers, having in mind the new food hygiene regulations which were likely to require all shopkeepers to provide constant hot water for their assistants.

Mr. Henry Brooke said the Chancellor of the Exchequer would bear this point in mind, but it could not be regarded as a conclusive reason for exempting these appliances from tax.

North Wales Water Power

The North Wales Hydro-Electric Power Bill, authorizing the Festiniog and Rheidol hydro-electric projects of the Central Electricity Authority, passed its remaining stages in the House of Commons last week and received the Royal Assent.

RUGBY RADIO STATION

Advances in Control Technique

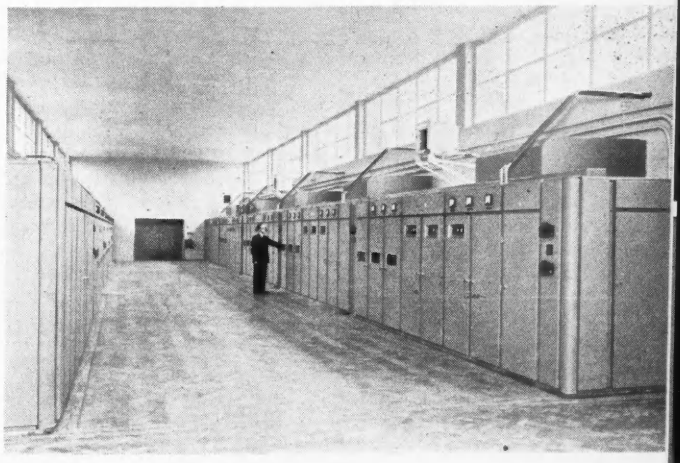
THE official opening by the Postmaster General last week of the £1 million extension to the Post Office Radio Station at Rugby marks a step forward both technically and in the world-wide telephony and telegraphy service provided.

The original station was built in 1926 with the well-known transmitter GBR giving a telegraphy service on 18,750 metres, to every part of the world. In the early 1930's, when high-frequency communication developed, a new building was erected to accommodate transmitters working on frequencies of from 3 to 30 Mc/s. The demand for h.f. services has continued to grow and it was decided to build a completely new station alongside the old one at Rugby. The site is on the opposite side of Watling Street to the original one as shown in our diagram.

Economy in man-power is an important consideration as the heavy demand for technical skill in the Rugby area makes the obtaining of staff more difficult. In this installation not only is Rugby established again as the largest transmitting station in the world but also as the most advanced in control and operating-technique. The number of transmitters in service has been doubled, but the traffic-handling capacity is approximately trebled, while the increase in staff is only 30 per cent.

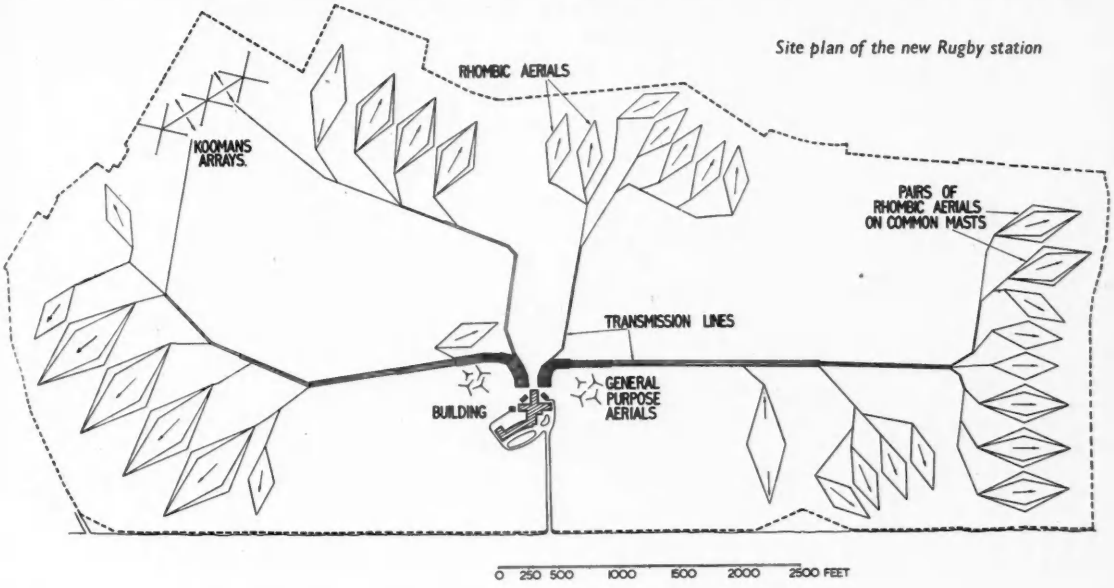
The new station has been designed to provide radio-telephone, telegraph and picture services to many parts of the world. The building houses 28 high-frequency transmitters with their auxiliary equipment, and to cover the many services required, the transmitters have to work on various frequencies and be connected to several aerials in turn. For this reason the site, which extends over 700 acres, has been made large enough to accommodate as many as 100 different aerials, of which 60 have so far been constructed.

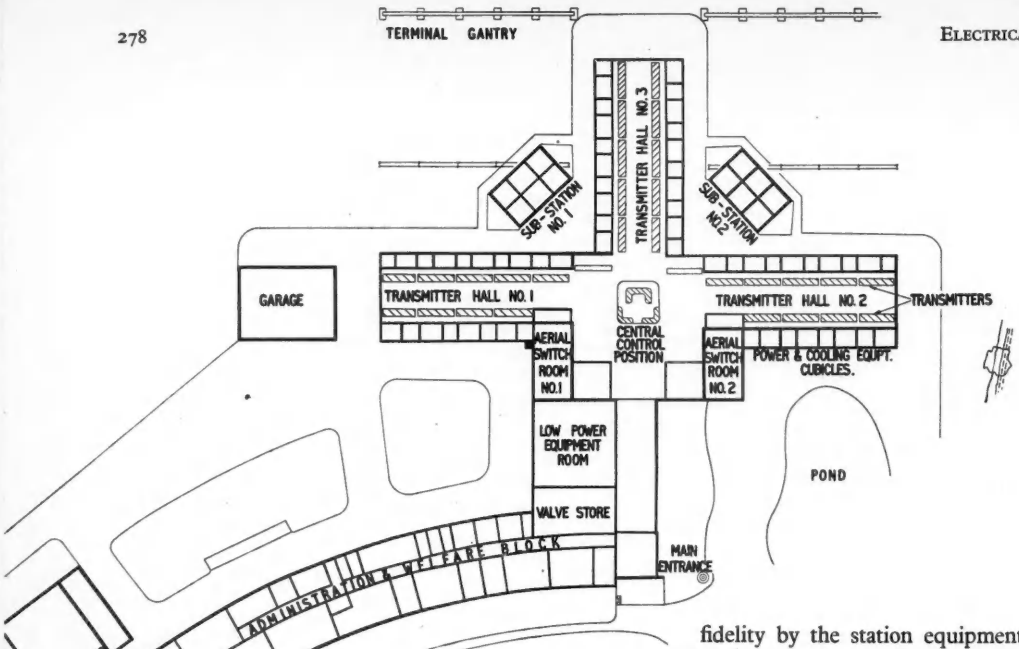
At other radio stations, daily frequency changing and aerial switching, and the continuous monitoring of performance which is essential if efficient services are to be maintained, are usually performed by transmitter attendants, and absorb much time and staff. At the new station, however, these routine functions are carried out automatically by specially designed equipment controlled from a single permanently staffed position. Thus, it is possible from this central control position, to start and stop the transmitters, check that they are working satisfactorily, and make the daily changes of operating frequency and aerial connection that are needed for the various services. At this position information on the performance of each transmitter carrying traffic is continuously displayed, and further facilities are provided for a more detailed check of any particular transmissions. As far as is known, this is the most complete system of remote control used in any large transmitting station in the world.



One of the transmitter halls

Site plan of the new Rugby station





Layout of the buildings

From the central control position three transmitter halls radiate at right angles, and adjacent rooms contain aerial-selector switches and the low-power equipment associated with the transmitters. Administrative and other accommodation is provided in a curved wing at the front of the building. The main and emergency power supplies are brought from the old station by two high-voltage feeders which terminate in substations behind the new building.

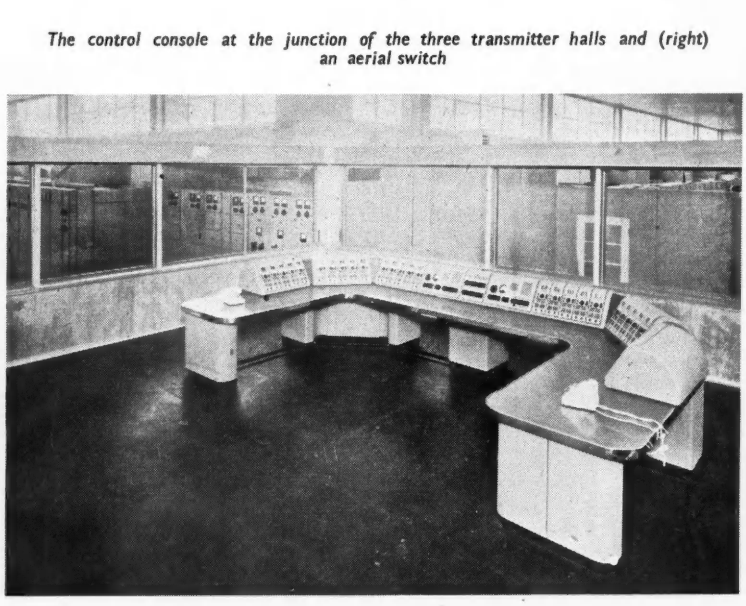
The signals arriving at the station by land-line from London, are translated into forms suitable for application to the transmitters by two types of drive unit, one for telephony, multi-channel telegraphy and picture transmission, and the other for different types of telegraphy. The drive units deliver low-power signals centred on a frequency of 3·1 Mc/s to the transmitters, all of which are of the same type regardless of the transmissions for which they are used.

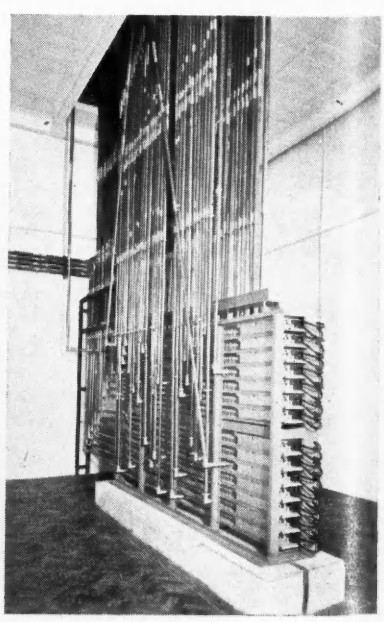
Each drive unit includes a monitoring receiver, which is used in conjunction with other apparatus for comparing automatically the signals arriving at the station with those leaving the transmitter. If the incoming signals should not be reproduced with sufficient fidelity by the station equipment, an indication is given at the central control position.

Transmitters

Each transmitter accepts low-power signals from the associated drive unit, translates them to any required frequency between 4 and 27·5 Mc/s (wavelength 75 to 11 metres), and raises them in level to some 20 or 30 kW before delivering them to the aerial-feeder system. Furthermore, the form of the signals is very accurately preserved, which enables a transmitter to deal with several independent signals at the same time without appreciable interaction; for example, four telephone channels, or two telephone channels and six telegraph channels can be handled simultaneously by one transmitter without mutual interference. Harmonic radiation, which is a potential source of interference with television, is negligible, the power radiated being generally less than 0·02 W. From the central control position, action can be initiated which adjusts a transmitter automatically for operation on any

The control console at the junction of the three transmitter halls and (right) an aerial switch





one of six pre-selected frequencies, and connects it to the corresponding aerial.

On the control desk are concentrated the control panels for the individual transmitters, and order wire, intercommunication and monitoring facilities. At this desk, the working conditions of all radio equipment are indicated and, under traffic conditions, complete operational control of the station can be exercised by one or two men. Telegraph transmissions can be specially checked by equipment situated elsewhere in enclosures.

The majority of the 60 aerials so far provided are multi-wire rhombics which, being non-resonant, work over a wide range of frequencies. Had resonant aerials been used, many more would have been needed, and, apart from the extra space and expense involved, this would have complicated the aerial switching arrangements. The aerials are connected to the station building by open-wire transmission lines, but, because of the difficultry and danger of accommodating many high-voltage open-wire lines in a confined space, balanced coaxial feeders are used inside the building.

Complete flexibility of connection has many operational advantages, and to make all the aerials available to all the transmitters two interconnected motor-driven aerial-selector switches are used, one of which is illustrated. Each of the 14 transmitters associated with this particular switch is connected to a separate horizontal switch deck, and up to six of the aerial feeders which descend vertically on both sides of the switch can be connected to any one deck. On turning a switch at the central control position a transmitter can be connected through the switch deck to any one of the six aerials. The sloping tubes shown are cross-connections to the other selector switch by which full flexibility is achieved.

All the transmitters, aerial switches and control system were manufactured by Marconi's Wireless Telegraph Co., Ltd., to Post Office specifications. The Marconi type HS51 transmitter used is a 30 kW long-range installation designed for operation on independent sideband telephone or frequency-shift and on/off telegraph services. Air cooling is employed throughout and the power supplies to each transmitter are situated on the opposite side of the transmitter hall walls with access from outside. This is to minimize fire risks.

The outdoor open-wire lines from the aerials feed on the roof into coaxial feeders of solid copper tubing, kept under a pressure of dry air. These lead to the aerial switches, where the vertical aerial feeds are telescopic to enable the end connectors to plug in to any of the horizontal aerial selector switches required.

The buildings are all of single-storey construction, decorated internally in attractive colour schemes. A long sun lounge for the relaxation of staff and visitors connects the entrance to the transmitter halls.

NEW BOOKS

Electric Railway Engineering. By T. Ferguson, A.M.I.E.E. Pp. 416; figs. 127. Macdonald & Evans, Ltd., 8, John Street, Bedford Row, London, W.C.1. Price 57s 6d.

The work of the traction project engineer, in the fullest meaning of the title, covers a very wide field. The engineer engaged in this branch must have a strictly practical outlook, backed by a sound theoretical knowledge of railway operation from the electrical engineering viewpoint. Mr. Ferguson sets out to detail this theory and most adequately fulfils his aim. The book is packed with information which will help the engineer to predict technical and economic results of the application of electricity to railway traction engineering.

The main bulk of the literature concerns rolling stock, in particular, movement and braking. Power supply considerations and rectifier substation capacity calculations are dealt with in sufficient detail for the specialists in these branches to be supplied with the appropriate information. The chapters which deal with choice of system, economics and the merits of the respective thermal-electric motive power units should be used as a guide to the method of determination only. This is particularly true of those sections detailing systems, in the light of the advent of further non-experimental high voltage industrial frequency a.c. electrification in France and elsewhere.

In a work of this magnitude, in the first edition, some errors are expected and one such error occurs in the definition of equivalent straight line braking. The definition given differs in fundamentals from that previously published, for instance in a paper entitled "Electro-Pneumatic Brakes," by H. R. Broadbent, *Journal I.E.E.*, Part 1A.

The volume is amply provided with curves and line diagrams; photographs are totally absent. Many of the curves, however, are not fully annotated, and have to be read in conjunction with the text.

Although written as a text-book and, as such, not particularly "readable," Mr. Ferguson's book is of great importance and will become and remain the standard work of reference on the subject. It is to be hoped that a second edition will be available very soon which will correct the errors such as have been mentioned.—R.N.

Lamps for a Brighter America. By Paul W. Keating. Pp. 246 + viii; figs. 44; index. McGraw-Hill Publishing Co., Ltd., 95, Farringdon Street, London, E.C.4. Price 30s.

The scope of this book is very fittingly described by its sub-title, "A History of the General Electric Lamp Business," and the author has proved himself a diligent historian of this great American organization, starting from the work of Edison and taking the story almost to the present day. If the uninitiated reader gets the impression that almost every step in the development of the electric lamp has resulted from work carried out in the U.S.A., and generally by members of the staff of the G.E. and its associated companies, that is a testimony to the thoroughness with which the author has thrown himself into the task which he himself defines by the question, "Have we given a reasonably true picture of 75 years in G-E lamp history?" and not, be it noted, "Have we given a balanced account of the history of the electric lamp during the last 75 years?" If this point seems to be unduly stressed, the reason is that the main title implies that the book is a history of lamps whereas in fact at least as much attention is devoted to patents and patent litigation as to filaments or fluorescent materials. Technical matters, it is true, are not excluded and the activities of the Nela Park propagandists are well described, but so is the "agency-distribution plan" for marketing lamps, devised as a result of the 1911 anti-trust suit.

The book is well printed and free from obvious errors (although W. E. Forsythe seems to have lost the final "e" throughout) but the lay-out of the half tone illustrations (many of them portraits of G.E. personalities) leaves something to be desired on English book production standards. —J.W.T.W.

GENERATION AND DEVELOPMENT

Winter Power Prospects

Unless the weather during the coming winter is of " extreme severity " no power cuts should be necessary although voltage reduction may still be required, stated the Electricity Sub-Committee of the Joint Consultative Committee of the Ministry of Labour in a report published last week. A change is recommended in winter peak hours. These are now defined as being:—Monday-Friday: November 4 p.m. to 5.30 p.m.; December and January 8 a.m. to 12 noon and 4 p.m. to 5.30 p.m.; and February 8 a.m. to 12 noon. Previously the months have not been named, and " winter " peak hours, Monday to Friday, were given inclusively as from 8 a.m. to 12 noon and from 4 p.m. to 5.30 p.m. An appeal is to be made to domestic and small commercial consumers of electricity for economy during the peak times.

The Sub-Committee's main recommendation is that Regional Boards for Industry should continue to use discretion to make load-spreading arrangements. Plant capacity available in mid-December, 1955, will, it is estimated, be some 17,200 MW. On this basis the estimated gap between supply and demand at the week of greatest risk (third week in December) is—average weather 400 MW; average cold spell 1,000 MW; extreme severity 2,000 MW. The corresponding estimates last year were 400, 1,200 and 2,100 MW, respectively, so the position has improved slightly.

Reviewing last winter's experience, the report says that load shedding by disconnection of supplies was necessary only once, but voltage and frequency reductions occurred on 17 other days between October and January. On five of these days there were reductions at both morning and afternoon peaks.

The Sub-Committee does not propose to issue further annual reports unless unforeseen developments occur, but intends to remain in being ready to act at any time should the need arise.

Higher " Seeboard " Tariffs

In a statement last week on the effect of the increased coal prices Mr. Norman Elliott, chairman of the South Eastern Electricity Board, said that the Board was compelled to advance most business and domestic charges to cover part of the extra cost and to preserve a fair relationship with charges to industry. Quarterly and fixed charges would not be altered, nor would the off-peak rates of 1d and 0·9d, but the " unit " charge of the domestic and business two-part tariffs would be raised from 1d to 1·1d. Charges for lighting on the standard flat rate would not be increased. The Board was taking the opportunity to standardize flat and block prices for cooking, heating and power; these ranged to-day from 2d to 4d and were to be standardized at 2¼d/kWh.

The price of coal was increased in July but the new charges for electricity would not come into operation until the first meter readings after 30th September. Savings made by " Seeboard " had offset successive increases in coal prices and rising costs of labour and materials, or had deferred their impact on electricity consumers, during the past four years. In this period " Seeboard's " own costs of distribution had been reduced by nearly 15 per cent. Staff had been cut by 600 although 130,000 additional consumers had been connected. Further savings were planned but they could not alone meet the much increased costs the Board suffered from the latest rise in coal prices.

East Midlands Revisions

From the first meter reading after 1st October consumers in the East Midlands area will pay 5d/kWh under the initial block of the domestic tariff (instead of 4½d) and the number of kWh at this rate will be increased from 30 to 36 for the first three rooms and from 9 to 11 for each additional room. The follow-on rate will remain unchanged at 1d/kWh. Tariffs for farms and combined premises will be subject to a similar adjustment. Commercial tariffs 2 and 3 (flat rates for separately metered supplies) will be increased to 5½d/kWh for lighting and 1·6d/kWh for other purposes. Under industrial tariff " C " (block tariff) the " unit " charges will be 2·10d for the first 3,000 kWh a quarter, 1·85d for the next 3,000 and 1·60d for all additional consumption. It is estimated that there will be an additional revenue of £1½ million in a full year.

Announcing the changes last week, Mr. C. R. King, chairman of the Board, said that because of increased sales the Board had managed to avoid raising tariffs during the past 2½ years despite substantial increases in the costs. The latest rise in the price of coal, however, which would add about £1½ million to the Board's costs, made an increase in tariffs inevitable.

North Eastern Charges

At a special meeting of the North Eastern Electricity Consultative Council last week the chairman of the Board, Mr. T. M. Ayres, reported that increases in charges were necessary owing to the phenomenal rise in costs. These increases to domestic and commercial consumers would be in the region of 11 to 12 per cent, he said. After considering this report the Council adopted a resolution in which it regretted that the stabilizing policy of the North Eastern Electricity Board had been frustrated by the imposition of costs over which the Board had no control.

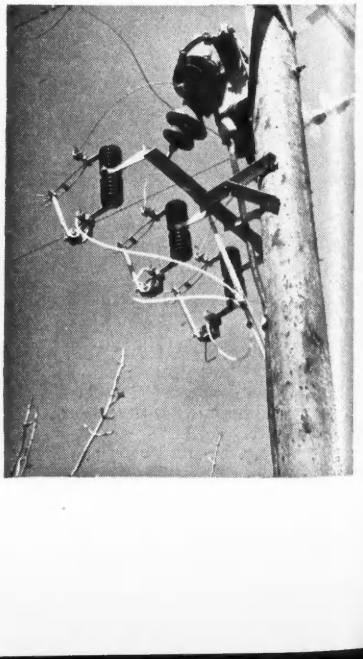
Temporary Supply Cable

Among the measures taken by the South Western Electricity Board to minimize supply interruptions has been the employment of mobile generating sets to provide temporary supplies whenever possible while essential work is carried out on the system.

The Board has also carried out successful experiments in Cornwall, in co-operation with Sterling Cables, Ltd., in the use of a flexible type of trailing cable insulated with polythene to provide a temporary supply when, for example, poles have to be replaced and an 11 kV overhead line has to be re-erected. The cable is run out across the countryside following the route of the original line and is connected to a suitable section point of the overhead line. The experiments were carried out under the direct supervision of Mr. L. F. Weir, Cornwall Sub-Area engineer. The length of cable run used up to the present is 1,000 yd, but experiments are being conducted by the manufacturers in the design of a suitable dry connector, which would mean that longer lengths of cable could be used conveniently. The radial thickness of the polythene insulation (0·150in) is in excess of that necessary for the purpose of electrical insulation, but was chosen to give added mechanical strength and safety.

To make the handling of the drums of cable easier it is proposed to construct a small drum transporter. This transporter is being designed so that it can put the drums straight on to specially prepared drum stands. A light cable roller capable of being spiked into the top of hedges is also being manufactured.

Polythene trailing cable connected to fuse-gear on transmission line terminal pole



NEW ELECTRICAL EQUIPMENT

Impedance Tester

The need for a reliable test of earth loop resistance measurement has led to the introduction by the BRITISH CENTRAL ELECTRICAL CO., LTD., 6-8, Rosebery Avenue, London, E.C.1, of

British Central Electrical Co.'s neutral loop impedance tester

an instrument which is claimed to overcome the disadvantages of the partial earth loop test by which faulty conditions existing back to the nearest earthed supply point are not revealed. Frequently the earth resistance is so high that installations, although apparently in good order, have been found to be unsafe in that heavy fault currents would fail to blow the fuses or operate the circuit-breakers protecting the installations. By injecting a heavy current through to the supply earth point, load conditions are simulated and true earth loop resistance is measured and faults thus revealed.

Housed in a polished wooden cabinet measuring 11½in by 7½in by 7½in, the instrument comprises a double-wound transformer, a direct-reading meter calibrated in ohms, two gas discharge warning lamps, protective fuses, and full facilities enabling it to be portable and easy to use. The instrument will measure the earth loop resistance of any normal electrical installation directly in ohms, indicate line and neutral and earth and neutral reversal, and check earth continuity at full load conditions. The actual weight of the instrument is 10 lb.

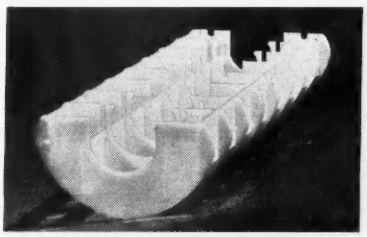
Welding Electrodes

The QUASI-ARC CO., LTD., Bilston, Staffs, announces the addition of "Ferron" electrodes to its range of electrodes for welding mild steel. These are designed for the welding of mild steel in all positions, particularly heavy sections or joints of a highly restrained nature; also for welding commercial steels of higher carbon, alloy or sulphur contents than normal mild steel of welding quality.

The electrodes are suitable for engineering and shipbuilding applications where weld metal having a low transition temperature is essential; moreover, the sound fine-grained weld metal deposited makes them especially suitable for pressure vessel work where a high standard of radiographic examination must be met. They are made in sizes of 12 s.w.g. to $\frac{5}{16}$in diameter, comply with B.S. 639: 1952 and are approved by the Ministry of Transport and Civil Aviation and Lloyd's Register of Shipping for welding mild steel in all positions.

Louvre Attachments for Fluorescent Tubes

The Atlas Lighting Division of THORN ELECTRICAL INDUSTRIES, LTD., 105-109, Judd Street, London, W.C.1, has introduced a new translucent opal plastic louvre attachment for 1½in fluorescent tubes. Under the name "Clipluve," it is designed primarily for use with single-tube fittings, and may be attached to bare tubes in any fitting to form an attractive, low priced louvre, eliminating glare and giving a



Atlas clip-on louvre

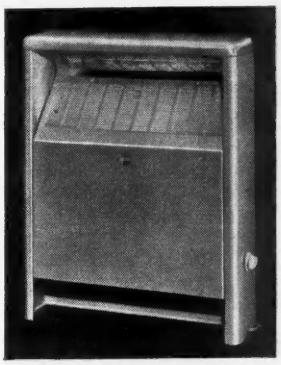
good degree of diffusion without materially affecting efficiency.

Moulded in sections 11in long, "Clipluve" is packed in cartons containing sets of five to fit a single 5ft 80 W tube. No tools are needed for installation. The sections are pressed into place against the tube, a simple locking device retaining them securely. The attachments are easily removed and can be cleaned with soap and water.

Convector Heater

The latest addition to the range of heating appliances manufactured by HURSEAL, LTD., 229, Regent Street, London, W.1, incorporates a ruby coloured lamp which illuminates, through the sloping louvres, a curved chromium reflector. The three-heat switch also controls the lamp which glows softly at low heat and brightly at medium and high heats. The front, which is secured by two screws above the louvres, swings forward to allow easy access to the elements, switch mechanism and lamp.

Cold air enters at the bottom through



Hurseal 2 kW convector heater

protective expanded metal and travels over the horizontally arranged 2 kW open wire spiral elements, returning to the room through the sloping louvres at a temperature of 260 deg F.

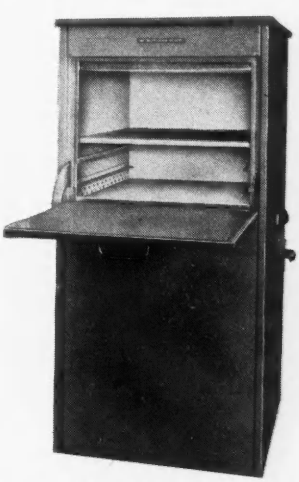
The heater is attractively finished in light bronze stoved enamel and measures 30in high by 24in wide by 6¼in deep. The price is £10 19s 6d, plus £4 0s 3d purchase tax in the United Kingdom.

Infra-red Oven

A new standard infra-red oven has been designed by the METROPOLITAN-VICKERS ELECTRICAL CO., LTD., Trafford Park, Manchester, 17, for the heat processing of small articles and materials in batch production. It is suitable for paint stoving, drying of lacquer, moisture drying from chemicals and foodstuffs, etc., curing and softening plastics and the drying of adhesives.

The oven consists of a floor-mounted sheet steel casing housing infra-red tubular sheathed heating elements in trough shaped anodized aluminium reflectors in the top of the oven which heat the materials in the oven by direct radiation. To conserve any stray radiant heat, the sides and floor of the oven are also lined with anodized aluminium sheet.

A wire mesh tray is provided for



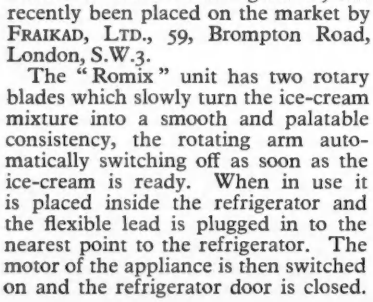
Floor-mounting Metrovick infra-red oven

use in the oven at various heights. All aluminium surfaces are anodized by the Brytal "C" process to ensure maximum heat reflection and also as protection against atmospheric corrosion. The drop-down door is counter-weighted to remain in an open or closed position. The oven is ventilated round the sides of the top cover into the surrounding atmosphere, but for processes where fumes are given off a suitable flanged outlet can be fitted to take ducting. Total electrical load is 4 kW and the approximate overall dimensions are 4ft 10in by 2ft 6in by 2ft 6in.

Ice-Cream Maker

An ice-cream maker, designed to be fitted into standard refrigerators, has recently been placed on the market by FRAIKAD, LTD., 59, Brompton Road, London, S.W.3.

The "Romix" unit has two rotary blades which slowly turn the ice-cream mixture into a smooth and palatable consistency, the rotating arm automatically switching off as soon as the ice-cream is ready. When in use it is placed inside the refrigerator and the flexible lead is plugged in to the nearest point to the refrigerator. The motor of the appliance is then switched on and the refrigerator door is closed.



"Romix" ice-cream maker

No harm is done to the cord as it is specially designed for this purpose. According to the recipe used for the mixture, the time taken to make ice-cream is from 1 to 2 hours.

The price is £8 10s 6d, plus £3 2s 5d purchase tax in the United Kingdom.

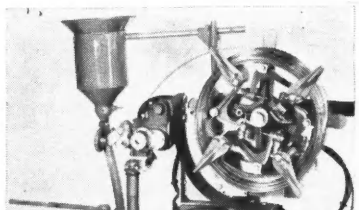
Heavy-duty Vibrator

A 100 W heavy-duty vibrator designed originally for Service use but now commercially available, is being produced by the PLESSEY CO., LTD., Ilford, Essex. It can be used in a power pack to give a variety of a.c. output voltages for supplying bias circuits, valve heaters requiring isolation, e.h.t. supplies, etc. Typical operating figures are an input of 24 V, 8 A, d.c., and an output of 175 V, 145 mA, d.c., 6·3 V, 3·25 A, a.c., or 6·3 V, 350 mA, a.c.

The vibrator is made to withstand the temperatures, humidities, vibration and shocks to which Service equipment is liable. It is hermetically sealed in a robust aluminium case of such wall thickness that mechanical noise is kept to a very low level. Its size is 4¼in high by 2¼in diameter. It is of the synchronous type, working at a frequency of 110 c/s nominal, having a split reed and a separate drive, and taking a maximum of 5 W driving power.

Self-expanding Wire Reel

A new wire reel has been developed for holding coils of electrode wire for "Unionmelt" and other continuous welding processes. The important



Quasi-Arc reel for welding wire

feature of this reel, which is made by QUASI-ARC/FUSARC, LTD., Bilston, Staffs, is that it will accommodate random-wound wire coils without any tendency for the coil to expand as it unwinds. A random-wound coil of wire cannot be held to close dimensions. For instance, a coil for fitting on a 12in diameter reel may have an internal diameter of 12-13in. Where a coil is a loose fit on a fixed diameter reel it will expand as the reel rotates, and may reach unmanageable proportions.

The new reel obviates this trouble by having four fingers, spring loaded, to press against the internal diameter of the wire coil. The fingers are mounted on bell cranks pivoted on the four spokes of the reel. The reel is quickly made ready for loading by rotating the four fingers through 180 degrees. The fingers have eccentric cams which enable the effective diameter of the reel to be varied by 2in.

Kieft Thermostat

CYRIL KIEFT & CO., LTD. (Thermostat Division), 13, Dudley Road, Wolverhampton, have introduced an addition to their range of thermostats, known as the A.55. The neat plastic cover fits flush with the base, obviating dust traps, and is easy to clean. A neon indicator lamp is fixed as standard on the front and all models are fitted internally with a cartridge type fuse.

The temperature range now covers 30 to 90 deg F. Cable entry is through the rear for concealed wiring installations and "knock-outs" are provided for the standard conduit box or wall mounting. On the other hand, cable entry can be made through the base of the thermostat through the rubber grommet provided, and connections are easily made to side-by-side 15 A terminals where it is desired to use it as a portable thermostat. The price of the A.55 type is 47s 6d.

High Quality Amplifier

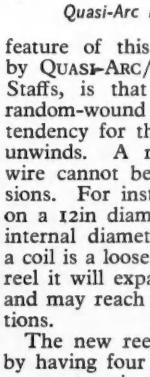
The GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, W.C.2, has introduced a new professional high quality amplifier for use in sound reproduction systems where critical and accurate listening is essential. It is suitable for recording studio monitoring, for musical appreciation groups in schools and elsewhere, for special demonstrations in small halls and for the highest quality public address systems. The amplifier can also be used in the home and is of particular interest to high fidelity enthusiasts and musical connoisseurs since it provides an exceptionally high standard of reproduction at true natural volume.

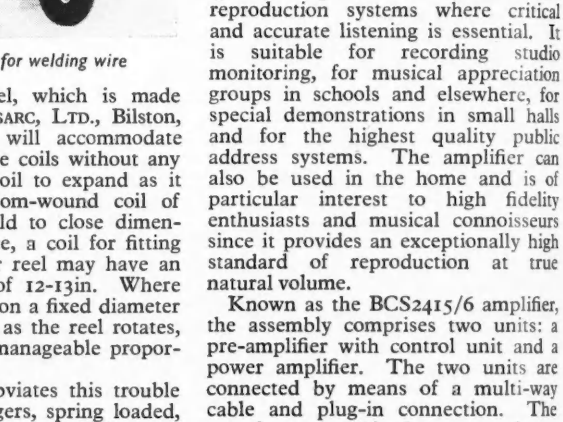
Known as the BCS2415/6 amplifier, the assembly comprises two units: a pre-amplifier with control unit and a power amplifier. The two units are connected by means of a multi-way cable and plug-in connection. The complete assembly has a maximum power output of 25 W at only 0·4 per cent total harmonic distortion, and covers the audio frequency range from 30 c/s to 20 kc/s, the output being level to within ± 0·5 db from 40 c/s to 15 kc/s.

The amplifier is designed for three alternative inputs, microphone (2·4 mV at 200,000 ohms), gramophone (10 mV, with correction networks for British long-playing, British 78 E.M.I. and 78 Ffrr (Decca) records), or radio receiver (100 mV).

The assembly will operate from 100-130 or 200-250 V a.c. supplies at 50/60 c/s. The price is 60 gns.

Kieft thermostat





G.E.C. high quality amplifier

Financial Section

STOCKS and SHARES

BY the beginning of this month, Stock Exchange markets seemed to have recovered equilibrium after a severe bumping over the time of the Chancellor's statement on economic affairs, at the close of the Parliamentary session. His "tightening-up" measures proved to be milder than those for which the industrial markets had braced themselves, and the course of prices levelled out on a plane not much lower than it was beforehand. By way of a change, welcome to holders of Government securities, the gilt-edged market reacted favourably to those parts of the proposals affecting money and exchange matters, and to the marked improvement in the pound sterling which followed them. In the electrical equipment market, interest has centred mainly on new issue activity.

Colvern Holdings

There was a large public demand for last week's marketing of Colvern Holdings 5s shares. Opening at 18s 9d the price moved quickly ahead to 21s 6d. Advertised particulars of the issue described the operating company as manufacturers of component parts for the electronic industry and, in particular, potentiometers and variable resistors. It is believed to be the largest company in Europe specializing in these components. Customers are stated to include most of the leading manufacturers of electronic apparatus, and also, several Government departments. A ten-year table shows an expansion (before tax and directors' emoluments) in profits over that period from £38,000 to £169,000, the peak figure being £273,000 for 1953/4, which the directors say was due to some exceptional factors. Issued capital of the company is £175,000.

Dividend Prospect

In the advertised statement, the directors of Colvern Holdings report that trading remains satisfactory. Considering the rate at which new orders are being received, they anticipate that profits in the current year, ending next March, should be higher than those of 1954/5, which were affected by the transfer of certain departments to a new factory. In these circumstances, they expect to be able to recommend an ordinary dividend at the rate of 20 per cent per annum. On the basis of a net profit of £160,000, less debenture stock charges and taxation, such a payment would be covered more than three times over by the distributable surplus, and would give the shares a yield of 4·6 per cent at the price of 21s 6d mentioned above.

More Newcomers

According to reports, consideration is being given to the question of introducing to the Stock Exchange a part of the ordinary capital of the Simon-Carves Company, whose name has become more familiar to investors lately through its association with G.E.C. in the atomic power field. Dealings are expected to start next Tuesday, 9th August, in the 5s ordinary and £1 preference shares of James Scott & Company (Electrical Engineers). Particulars connected with the introduction of the shares in London and Glasgow were due to be advertised last Wednesday. At the Richardsons Westgarth annual meeting, the Chairman referred to the question of additional finance for the programme of capital expenditure, which now totals about a million and may increase further.

Metal Industries

Metal Industries hold a million and a half British Oxygen ordinary shares, so that one of the main points of interest coinciding with publication of the annual results is the action proposed in connection with the "rights" issue of new British Oxygen shares. Being entitled to 600,000 of these at the issue price of 50s, Metal Industries have placed the rights to 500,000 on terms stated to be satisfactory, and propose to use the greater part of the premium obtained in taking up the balance of 100,000 shares. A statement from the company says that the group's capital investment needs have first call on the company's resources. Preliminary figures relating to the year ended last March show a net group profit of £284,000 (against £333,000 in the previous period). The dividend is being maintained at 9 per cent, the rate to which it was reduced a year ago, and with the shares quoted at 31s the yield is now over $5\frac{3}{4}$ per cent.

British Oxygen New Shares

British Oxygen's new £1 shares have been changing hands at a premium of about 15s on the price of 50s at which they are offered to shareholders. After initial uncertainty, the market was reassured by news of the arrangements made by Metal Industries in dealing, as mentioned in the above note, with their big allotment. These new shares will not be entitled to the interim dividend for the current accounting period, which has been changed to end in September and will this time be of only nine months duration. They will be entitled to the final payment. Profits in this period are expected by the company to run at not less than last year's rate. For the last three years the ordinary dividend has been at 15 per cent, on which basis the prospective yield from the new ordinary shares at an all-in price of 65s (free of stamp) is rather more than $4\frac{1}{2}$ per cent.

New Issues

A growing number of companies is taking advantage of market conditions to raise new capital for the financing of fresh expansion plans. Most of these operations are taking the shape of "rights" offers of new ordinary shares to existing holders. It is a sign of these confident times that the prospect of an issue on terms attractively below the ruling market price commonly induces a favourable reaction from the shares concerned. In this same connection, attention may be recalled to the opportunity usually given on these occasions for shareholders to apply for "excess" shares, meaning those not taken up in the ordinary way through the exercise of rights. If the premium on the new shares is at all substantial, even a small number of extra shares may be well worth having.

Free of Stamp

Apart from the shareholders directly concerned, one effect of a "rights" issue of capital is of course the creation of public opportunities to acquire shares in the market free from the expenses of the 2 per cent stamp duty for the period during which they are transferrable in the form of allotment letters. A number of shares in electrical and associated companies are currently available in that form. They include recent issues by Telegraph Construction, Enfield Rolling Mills, Thorn Electric, Elliott Brothers, S. Bird, Peto Scott and Hackbridge & Hewittic.

For example it may be of passing interest to add that applicants for excess shares in the recent Telegraph Construction issue, were able to sell whatever allotments they received, at an immediate premium of 1s $10\frac{1}{2}$d per share. This means, of course, that those shareholders who did not bother to apply for their rights, were losers of the premium which otherwise they could have obtained.

THE "BLUEBIRD"

The power unit of Mr. Donald Campbell's *Bluebird III* was a "Metrovick" Beryl jet propulsion engine built some time ago at the Metropolitan-Vickers Barton works. It was not constructed for the purpose; on the contrary it is better known as the forerunner of some present-day aircraft jet engines. With its thrust of 4,000 lb, it was considered suitable for Mr. Campbell's purpose, with a minimum of modification to the engine itself. The main framework of the boat is of tubular construction, using chrome-molybdenum seamless steel tube mostly of 2in square section. The framework was electrically welded with "Metrovick" type EH electrodes.

REPORTS and DIVIDENDS

The Dubilier Condenser Co. (1925), Ltd.—The main figures in the accounts for the year ended 31st March last were given in our issue of 15th July.

In his statement which is circulated with the report and accounts, Mr. F. H. McCrea (chairman and managing director) says that the decline in the trading profit is due to variation in demand and consequent uneven loading, lower profit rates arising from intensified competition, higher labour and other operating costs. During the early part of the year some departments were not operating to full capacity, but in the second half of the year the volume and value of orders received were such that the productive capacity was insufficient to meet promptly the requirements of customers; even so, the quantitative production exceeded that of any other year. In the export market they exceeded last year's sales figures with products specially designed to meet overseas requirements. Installation of new plant at Acton is expected to be completed by September next. The erection of additional factory space at Kirkby was completed in August last year, and the transfer of plant to new locations and the installation of new plant has recently been completed. During the current year additional productive capacity is being brought into commission. The value of outstanding orders is greater than a year ago and the sales turnover for the first three months shows a satisfactory increase. A large proportion of the business is governed by the fluctuating demands of the radio industry, but they have developed a substantial business in capacitors and devices for the suppression of electrical interference in addition to capacitors for industrial applications.

The Telegraph Construction & Maintenance Co., Ltd., announces that in response to its offer to shareholders of 977,046 ordinary shares, 95 per cent of the "rights" were taken up. The balance of the shares was subscribed for over five times. Allotments against applications for additional shares will, therefore, have to be drastically curtailed.

Brown Brothers, Ltd., have declared an interim dividend of 2½ per cent (unchanged). The directors propose to make a free scrip issue on the basis of one for two. The board emphasizes that the proposed adjustment to the capital structure does not imply the intention to distribute the same percentage dividend.

Thomas de la Rue & Co., Ltd.—In the course of his speech at the annual meeting held on 27th July, Mr. B. C. Westall (chairman) said that the Plastics Division had a very good year. There was a substantial increase in the turnover both at home and for export. In spite of increases in certain costs, the substantial expansion of sales of "Formica" had enabled them to reduce the selling price. There had also been a satisfactory increase in the sale of "Delaron" industrial laminates. Technical developments in these products, particularly the copper-clad grade, had been encouraging. Further plant was being purchased for the Tynemouth factory which would enable the turnover to expand.

Richardsons, Westgarth & Co., Ltd.—Addressing stockholders at the annual meeting held on 27th July, Mr. O. J. Philipson (chairman) said that their capital commitments on capital expenditure now totalled about £1,000,000 and that additional such expenditure was now under consideration. The board was at present considering the question of how far it might be necessary to procure additional finance for this programme. Stockholders would be informed as soon as possible of any decision that might be reached. The No. 1 turbo-alternator at Portobello power station, manufactured at their Hartlepool works, again headed the efficiency list of all power stations throughout the country for 1954-55.

James Scott & Co. (Electrical Engineers), Ltd.—Arrangements have been completed for the marketing on the London and Glasgow Stock Exchanges of part of the company's capital. Issued capital consists of 200,000 6½ per cent £1 cumulative preference shares and 1,016,148 ordinary 5s shares. Bentworth Securities is subscribing for the preference shares and placing them at par, together with approximately 250,000 of the 5s ordinary shares which are being purchased from the present shareholders. The ordinary shares are being placed at 11s 3d to yield 7¾ per cent on a forecast dividend of 17½ per cent. It is expected that dealings will start on 9th August.

Simon-Carves, Ltd.—In our report of the chairman's statement which accompanied the annual report and accounts, published in our issue of 22nd July, we inadvertently referred to Lord Simon as chairman. Lord Simon is president of the company, the chairman being Mr. R. B. Potter, by whom the statement was issued.

Hoover, Ltd., are paying an interim ordinary dividend of 10 per cent (unchanged).

New Companies

Barr's Retail, Ltd.—Registered 19th July. Capital £10,000. Manufacturers and repairers of and wholesale and retail dealers in electric lamps, fires, stoves and cookers, telephonic and television and wireless apparatus, etc. Mrs. Edith Barr is the first director. Regd. office: Market Place, Denton, Manchester.

Electric House (1955), Ltd.—Registered 19th July. Capital £20,000. P. L. Barr is the first director. Objects and other particulars are similar to Barr's Retail, Ltd.

J. R. Ferguson (Electrical Engineers), Ltd.—Registered 13th July. Capital £1,000. Directors: J. R. Ferguson and Margaret W. Ferguson. Regd. office: 72, Bridge Street, Manchester.

Bridgewater Electrical Fittings Co., Ltd.—Registered 11th July. Capital £2,000. To acquire the business of company of same name, etc. Directors: G. W. Johnson and W. J. Fuller. Solicitors: George Roberts & Co., 6, Chichester House, Chichester Rents, W.C.2.

Pengam Engineering, Ltd.—Registered 11th July. Capital £10,000. Electricians, electrical engineers and contractors, etc. The first directors are not named. Regd. office: Pengam Road, Aberbargoed, Bargoed.

Gordon & Moodycliffe, Ltd.—Registered in Edinburgh 23rd June. Capital £1,000. Electrical engineers, electricians, contractors for any kind of electrical work, etc. Directors: E. Moodycliffe, J. Moodycliffe and E. H. Moodycliffe. Regd. office: 176, Irish Street, Dumfries.

Lambard Smith (Radio & Television), Ltd.—Registered 9th July. Capital £1,000. Wholesale and retail electrical and radio engineers, etc. Directors: M. R. Smith and P. Lambard. Regd. office: 5, Great Winchester Street, E.C.2.

Vide (Southern), Ltd.—Registered 2nd July. Capital £2,000. Manufacturers, reconditioners, repairers, purchasers and sellers of electrical appliances, dealers in radio and television sets, etc. Directors: F. King, H. W. Standbridge and C. A. Davies. Regd. office: 902, Wimborne Road, Bournemouth.

Nuclear Research Applications, Ltd.—Registered 4th July. Capital £100. Directors: Max Falk and Rebecca J. Falk (directors of M. Falk & Co., Ltd.). Regd. office: 34-40, Ludgate Hill, E.C.4.

Bankruptcies

J. H. Pickwell, carrying on business under the style of J. H. Pickwell & Co., as a retailer of electrical goods and handicraft materials at 79, London Road, East Grinstead, Sussex, and as an electrical engineer and contractor at 108, London Road, East Grinstead.—Receiving order made 20th July on debtor's own petition. First meeting to-day (Friday) at the Official Receiver's office, 8, Old Steine, Brighton. Public examination 28th September at the Court House, Crescent Road, Tunbridge Wells, Kent.

D. G. H. Hammerton and **A. J. Cummings,** trading as A.C.D. Electric Co., 28, West Street, Warwick, electrical engineers.—First and final dividend of 7¼d in the £, payable at the Official Receiver's office, Somerset House, 37, Temple Street, Birmingham, 2. (Amended notice.)